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ABSTRACT

This report presents findings, conclusions, and recommendations from a study of capital planning space standards and guidelines for classrooms, academic offices, research laboratories, and teaching laboratories in California. The report addresses the second and third of the study's three key objectives which were accomplished through three distinct phases of project work. The first phase was a national survey of all 50 states on how California's space standards/guidelines compare with those used in other states. The objectives of phases 2 and 3 were, respectively, (1) to evaluate the status of inventory measurement/record-keeping systems and space utilization study methods used in all three segments of California's public higher education system; and (2) to assess changes occurring in specific disciplines, since the current standards were set in the mid-1950s, which may have an impact on space needs. The products and results of each phase are presented in separate sections of the report and contain findings from California's community colleges, California State University, and the University of California. The final section has been organized to help the advisory committee for the project to identify and focus on issues and associated factors which must be addressed within the framework of an ordered agenda to overcome the complexities of this difficult and sensitive subject. Nine exhibits are included. (GLR)

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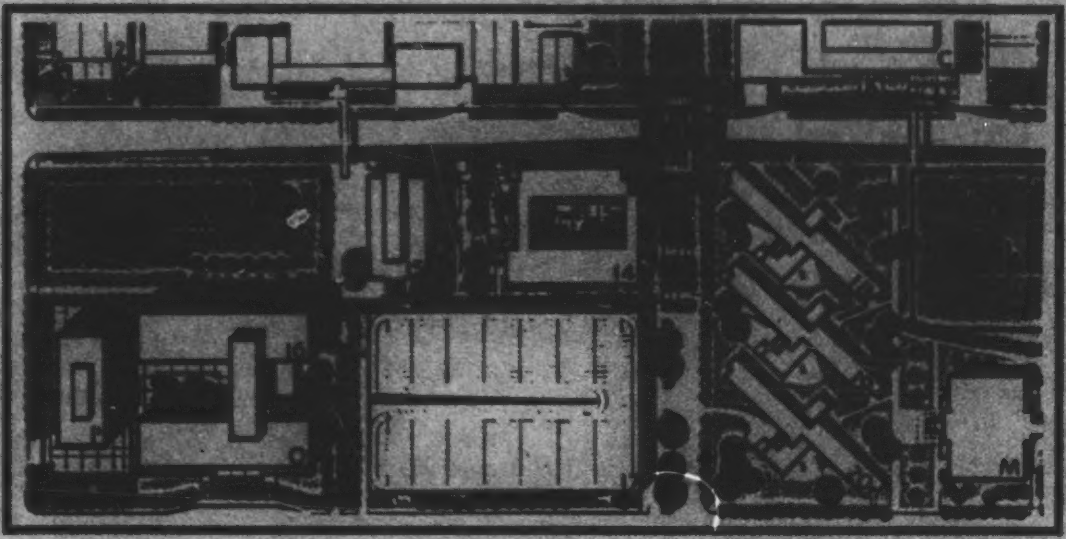
FINAL REPORT

STUDY OF HIGHER EDUCATION SPACE AND UTILIZATION STANDARDS/GUIDELINES IN CALIFORNIA



A THIRD REPORT OF MGT CONSULTANTS, INC.
PREPARED FOR AND PUBLISHED BY THE
CALIFORNIA POSTSECONDARY
EDUCATION COMMISSION

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A Third Report of MGT Consultants, Inc.,
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CALIFORNIA POSTSECONDARY EDUCATION COMMISSION
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1 Introduction

The State of California has been one of the leaders in developing an organized approach to facilities planning and capital budgeting. In 1947, the California Legislature, anticipating the post-World War II enrollment boom, authorized a comprehensive study of higher education facility needs. This study led to the "Strayer Report," which outlined objective space and room utilization standards for capital development. Subsequent efforts, including the 1955 restudy by McConnell, et al. and the standards developed by the Coordinating Council for Higher Education (CCHE) in the mid-1960s, produced "state of the art" criteria and guidelines. Although complete agreement was not achieved among all parties, the standards provided an objective base for capital planning and budgeting in a period of rapid growth.

During the period of the 1960s and early 1970s, similar efforts were made by other states and by the National Center for Higher Education Management Systems (NCHEMS). Unfortunately, however, only limited standardization was achieved, and NCHEMS' attempt to develop a definitive system fell short of its goal. As a result, states have developed their own systems, with differing bases and definitions, to meet their unique needs and work within their own political environment.

During the late 1970s and early 1980s, there have been only a few efforts to build on earlier work. Slower enrollment growth and funding restrictions reduced the emphasis on studies in this area. The decision of the National Center for Education Statistics to discontinue the collection of facilities information resulted in less available data on which to base changes.

California higher education is now facing a new set of challenges in planning for the future. Demographic changes indicate a pattern of substantial enrollment growth. Concern for the educational needs of "place bound" adults has increased pressure for extended services. Changes in technology and the approach to teaching and research has also produced continued pressure for facilities modifications. In addition, a need to renovate or replace many facilities built in the 1950s and 1960s is now emerging. Finally, the financial restrictions of recent years have resulted in increased pressure by State policy makers to re-examine existing space standards to determine their appropriateness.

In response to these issues and concerns, the California Legislature directed, through Supplemental Language added to the 1985-86 Budget Act, that the California Postsecondary Education Commission (CPEC) review and evaluate California's higher education facilities planning standards/guidelines. After a preliminary study of science and engineering disciplines, CPEC determined that the subject's scope and complexity warranted a comprehensive review with assistance from an outside contractor. MGT was selected to work with CPEC and an advisory committee representing the three segments of public higher education and the executive and legislative branches.

1.1 Study Objectives

MGT has completed the comprehensive study of capital planning space standards and guidelines commissioned by the California Postsecondary Education Commission.

The study was designed to accomplish three key objectives:

1. Compare California's space standards/guidelines with those of other states using standards/guidelines for facilities planning and budgeting;
2. Evaluate the status of inventory measurement/record-keeping systems and space utilization study methods used in all three segments of California's public higher education system; and
3. Assess changes occurring in specific disciplines, since the current standards were set in the mid-1950s, which may have an impact on space needs.

1.2 Scope of Study

The scope of this study was limited to a review of the space and utilization standards or guidelines for the following categories of space:

- Classrooms
- Teaching Laboratories
- Research Laboratories
- Academic Offices

The study excluded consideration of space standards for the health sciences, except at the community college level.

1.3 Overview of Methodology

The three objectives outlined above were accomplished through three distinct phases of project work which began in early 1988 and concluded in May 1989. Phase I included a telephone survey of all 50 states to identify states using space standards/guidelines for higher education facilities planning and budgeting. The telephone survey was followed by site visits to 18 states, four private institutions, and one Canadian province. During these visits, MGT gathered detailed data on states' space standards/guidelines and solicited opinions from key education, legislative and executive staff regarding their use. A separate report has been prepared which presents a detailed analysis of other states' standards/guidelines and compares them to those used in California.

That report, *National Survey of Space and Utilization Standards and Guidelines in the Fifty States*, should be referenced for information regarding how California's space standards/guidelines compare to those used in other states.

Results of Phases II and III of the study, addressing the second and third objectives outlined above, are presented in this final project report. To accomplish Phase II, MGT:

- Reviewed documentation from the system offices of each segment of higher education in California including instructions/guidelines for maintaining space inventory records and conducting space utilization reviews;
- Interviewed system office staff to learn the role of the central office in space inventory control and utilization analysis; and
- Conducted site visits to selected campuses in each segment to assess the degree of accuracy of inventory and utilization data. These visits did not constitute an inventory audit but were designed to establish the degree of confidence which may be placed in existing systems.

Phase II work focused on determining the congruity of inventory and utilization review systems among the segments and the general level of accuracy of data maintained.

Phase III reviewed changes affecting space which have occurred since California's space and utilization standards/guidelines were established.

This effort included:

- Reviewing available data to determine where enrollment shifts have occurred in different disciplines within the segments;
- Discussing changes in equipment usage, class size, use of non-lecture space for instruction, and use of computers with campus staff representatives during MGT's Phase II site visits; and
- Conducting focused discussion sessions covering selected disciplines with faculty and facilities planning representatives from each segment to identify what, if any, changes have occurred.

Twenty-four discussion sessions were held, including five in the Community College system, seven in the California State University system and twelve in the University of California system. Phase III focused on delineating changes which have occurred or are likely to occur increasing or decreasing the need for space in the various disciplines. Disciplines were selected based on discussions with each segment to identify where the greatest changes have occurred since California's standards were established.

1.4 Summary Description of Report

This report presents MGT's findings, conclusions and recommendations from work performed in

Phases II and III of the project for the California Postsecondary Education Commission (CPEC). The products and results of each phase are presented in separate sections of the report.

MGT has worked closely with an advisory committee throughout all phases of the project This committee, coordinated by CPEC and comprised of representatives of all three segments of higher education, the Department of Finance and the Legislative Analyst's Office, has played a key role in this unprecedented study. During the next several months, this committee will become a working group to interpret project results and assist CPEC in the formulation of recommendations for appropriate changes in California's space standards/guidelines. The last section of this report has been organized to help the committee identify and focus on issues and associated factors which must be addressed within the framework of an ordered agenda to overcome the complexities of this difficult and sensitive subject.

2 Intersegmental Analysis of Inventory and Utilization Review Methods

A primary purpose of this phase of the study was to determine whether or not current inventories of space among the three segments of public higher education in California were consistent to the degree that sound conclusions can be reached on the need for additional classroom, teaching laboratory, research laboratory and academic office space. Related questions included:

- Do the segments measure assignable square feet (ASF) the same way?
- Are the same types of space included in the overall ASF measurements?
- Is each type of space consistently defined and classified?
- How are inventories updated?
- What rules are used for treating special situations, e.g., joint or multiple use of a room?

Another primary purpose of Phase II of the study was to determine the availability and congruity of space utilization data in the three segments. Our approach to addressing these issues and questions was two-fold. We first reviewed the inventory and utilization systems used at the segment or central office level. This review was followed by on-site reviews at 29 California institutions of higher education.

2.1 Segment Level Reviews

University of California

In the case of the University of California, the inventory system is one of the few remaining elements of what at one time was a highly centralized space and utilization information system. Several years ago, much of that system was dismantled in a move to decentralize to the campus level. The centralized inventory uses definitions which, in the case of the space categories we reviewed, were consistent with nationally accepted definitions. The centralized inventory is fully computerized, updated annually and is used both centrally and at the campus level. It is building and room specific and contains information on the size and classification of the space. There have been no notable problems with consistency between the campus and university levels since the system does not track a "master plan" or prior use of the space. The inventory, therefore, reflects current planned use by the campus.

Although the University's central office does not produce space utilization reports, the inventory system is one component of the utilization reports which are produced at the campus level.

California State University

The California State University maintains a centralized inventory which is linked to a central space utilization analysis system. The CSU system is computerized, uses nationally recognized definitions and is updated annually. The Chancellor's Office maintains two data bases which support systemwide space inventory and the calculation of space utilization. The data bases are the Space and Facilities Data Base (SFDB) and the Curriculum Data Processing System (CDPS).

1. *Space and Facilities Data Base:* The Space and Facilities Data Base (SFDB) is designed in two files: the Facility File (building inventory) and the Space File (room inventory). The SFDB contains room specific physical characteristics, including:

- Room number and building number
- Room shape (regular or irregular)
- Room depth and width (optional)
- Assignable square feet (ASF) in each room

The other information contained in the SFDB are room designations broken into two categories, "Current Designation" and "Master Plan Designation."

These designations contain the following information:

- Organizational unit to which the room is assigned (if applicable),
- Type of space (lecture, teaching lab, faculty office, etc.),
- Level of course assigned to the space,
- Station type and number,
- Status of the assignment (permanent, temporary),
- Exempt code, and
- Date the Master Plan was last modified.

Any differences between the two designations for any space are the result of either an approved temporary change in use, size, etc. or a change which has not been approved.

Each spring every campus submits a printout and a computerized file which details all changes made to any room on campus. Each change is checked and if it was not made in accordance with an approved project, it will not be entered into the computer.

During our review, we were made aware of problems with the inventory system which had developed over the years. In the past, numerous changes made at the campus level were overruled or not processed by the central office. This resulted in disparities between actual use (and local records reflecting that use) and the Master Plan data shown in the SFDB. In the past two years, however, efforts have been underway to bring the SFDB into conformity with the actual size and use of the space and to improve the data processing system.

2. *Curriculum Data Processing System:* In addition to the change transaction file, each campus sends to the system office a faculty file and a scheduling file (also called a section file). The section file is used, in conjunction with an extract of the SFDB, to generate utilization data.

The Section File contains:

- Course identification
- Course location
- Actual enrollment
- Time
- Credit hours

The SFDB extract and the section file from CDPS are merged and sorted to produce a printout by campus, by building, by room number. For each room number, the printout contains the information listed above in the Section file. This merge produces error reports where:

1. SFDB capacity space is not scheduled;
2. If a course is scheduled into space not in SFDB; and
3. If a course is scheduled into non-capacity space.

The error reports are sent to the campuses and when corrections are returned either the SFDB extract or the CDPS extract are updated. The error review process reduces the use of inaccurate "Master Plan" space codes in the utilization calculations. However, the process does not flag lecture classes held in laboratory space (and vice versa), therefore a potential for some errors of the sort exist in the utilization system. The California State University is redesigning the SFDB so that changes can be made on a transactional basis and more categories of space can be developed to account for space with multiple uses. These changes should improve the reporting of utilization and maintain a more accurate space inventory.

The outcome of the process is the production of space utilization reports for each CSU campus. Three sets of tables are produced:

1. Utilization and station occupancy rates by time of day and day of week for classrooms and teaching labs;
2. Utilization data by room size; and
3. FTE production by room type.

Community Colleges

Inventory records for each community college are maintained centrally by the Chancellor's Office. Annually, each district sends an inventory update to that office on a form which has one line for each change. All information is transmitted manually and updates are entered centrally into the computer system. The resulting inventory printouts are provided to the districts and serve as the basis of existing capacity data for use in the five-year capital planning process.

The inventories are the basic source of data on space at the district level and no inconsistencies between local and central records were observed. There is no central calculation of space utilization in the Community College system.

2.2 Institutional Level Reviews

The second element of our review consisted of site visits to four University of California campuses, nine CSU institutions, and 16 community colleges. The purpose of these visits was to conduct a "hands on" review of the inventory and space use data on campus and compare official records with actual information, including:

- Verification of room use type and size;
- Comparison of similarly classified space among campuses and segments;
- Verification of room characteristics such as room number, lighting, number of work stations, type of work station; and
- Determination of the degree of consistency between the inventory record and the utilization record to the extent that they existed.

This part of the study did not constitute an audit of current records but was intended to establish the degree of confidence which can be placed in existing systems.

After conferring with institutional officials concerning issues dealing with both Phases II and III of the study, we used the official inventory data to randomly select several buildings which had a likelihood of containing the types of space to be reviewed. Within those buildings, we randomly selected four classrooms, four teaching labs, four academic offices and, where available, four research labs. We next conducted physical visits, determining the use of the room, its size, number of stations, accuracy of scheduled use, and relationship to any utilization data which existed.

Overall, it was evident that the segments measured assignable square feet in the same way, included the same types of space in ASF measurements and used generally consistent definitions of the subject space types. Only a few minor differences were observed. These differences did not affect the accuracy of the data.

The results of our reviews are summarized in Exhibits 2.1, 2.2, and 2.3. The exhibits indicate the categories of space reviewed and the observed accuracy and consistency of the official inventories in terms of assignable square foot measurements, student station count, and the classification of space. Both the number of significant deviations from the inventory and the net overall deviations for the rooms observed are indicated. Modest margins of error were used to eliminate minor differences of measurement or station count.

2.3 Availability of Space Utilization Data

As noted in Section 2.1, the California State University has a centralized method for calculating space utilization based on a university-wide data system. Utilization data are maintained for both classrooms and laboratories and reports are published by the Chancellor's Office indicating room and station occupancy rates by time of day, day of week and size of room Information on full-time equivalent (FTE) production by room type, including FTE produced in non-capacity space is also provided. Instructional activity in non-capacity space is excluded from the utilization statistics.

The University of California operates on a more decentralized basis with space utilization studies done by some campuses and not by others. All of the UC campuses visited during Phase II conducted some form of space use studies. The utilization reports include information on room and student station occupancy by time of day, day of week and size of room. Instructional activity in non-capacity space is excluded from the utilization data.

The Community College system does not require space utilization reports. Although some community college districts maintain information on room and student station use by time of day, we found no examples of a complete space utilization study providing statistical information for institutional management.

In reviewing space utilization statistics for the California State University and those University of California campuses producing utilization studies, it is important to keep the following in mind: The University of California studies we have observed deal with classroom utilization and count only

EXHIBIT 2.1 Sample Inventory Review, California Community Colleges

Classrooms: (62 observations)

- ASF
  - Deviations of 4 percent or more: 15
  - Overall Deviation: Actual was 0067 below inventory of 51,371 ASF
- Stations
  - Deviations of ±5 stations/±10% or more: 33
  - Overall Deviation: Actual was 20 above inventory of 3,986 stations
- Accuracy of Classification
  - 2 multi-use, 1 classed as teaching lab, 4 special use

Teaching Labs: (60 observations)

- ASF
  - Deviations of 4 percent or more: 21
  - Overall Deviation: Actual was .018 below inventory of 88,610 ASF
- Stations
  - Deviations of ±5 stations/±10% or more: 28
  - Overall Deviation: Actual was 20 above inventory of 2,038 Stations
- Accuracy of Classification
  - 3 used as lecture, 3 multi-use, 1 special use

Faculty Offices: (49 observations)

- ASF
  - Deviations of 4 percent or more: 14
  - Overall Deviation: Actual was .003 below inventory of 8,561 ASF
- Stations
  - Deviations of ±2 stations or more: 3
- Accuracy of Classification
  - No variance

EXHIBIT 2.2 Sample Inventory Review, California State University

Classrooms: (32 observations)

- ASF
  - Deviations of 4 percent or more: 11
  - Overall Deviation: Actual was .0013 above inventory of 24,458 ASF
- Stations
  - Deviations of ±5 stations or ±10%: 17
  - Overall Deviation: Actual was 12 above inventory of 1,503 stations
- Accuracy of Classification
  - 1 classed as teaching lab, 1 use double counted

Teaching Labs: (36 observations)

- ASF
  - Deviations of 4 percent or more: 11
  - Overall Deviation: Actual was .0003 below inventory of 45,491 ASF
- Stations
  - Deviations of ±5 stations or ±10%: 14
  - verall Deviation: Actual was 177 above inventory of 789 stations
- Accuracy of Classification
  - 2 listed as lecture, 2 had space used for offices

Research Labs: (16 observations)

- ASF
  - Deviations of 4 percent or more: 5
  - Overall Deviation: Actual was .003 above inventory of 10,471 ASF
- Stations
  - Deviations of ±3 stations: 2
- Accuracy of Classification
  - 1 shown as Research Lab Service in inventory

Faculty Offices: (33 observations)

- ASF
  - Deviations of 4 percent or more: 11
  - Overall Deviation: Actual was .004 above inventory of 4,801 ASF
- Stations
  - Deviations of ±2 stations: None
- Accuracy of Classification
  - 1 shown as Research Lab Service in inventory

EXHIBIT 2.2 Sample Inventory Review, University of California

Classrooms: (15 observations)

- ASF - Deviations of 4 percent or more: 1
  - Overall Deviation: Actual was .004 above inventory of 14,875 ASF
- Stations - Deviations of ±5 stations or ±10 percent: 4
  - Overall Deviation: Actual was 2 below inventory of 966 stations
- Accuracy of Classification - No revised use was noted

Teaching Labs: (14 observations)

- ASF - Deviations of 4 percent or more: 2
  - verall Deviation: Actual was .014 below inventory of 12,878 ASF
- Stations - Deviations of ±5 stations or ±10 percent: 1
  - Overall Deviation: Actual was 15 above inventory of 229 stations
- Accuracy of Classification - No revised use was noted

Research Labs: (14 observations)

- ASF - Deviations of 4 percent or more: 4
  - Overall Deviation: Actual was .066 above inventory of 6,893 ASF
- Stations - Deviations of ±3 stations: 2
- Accuracy of Classification - One space used primarily as office

Faculty Offices: (15 observations)

- ASF - Deviations of 4 percent or more: 2
  - Overall Deviation: Actual was .008 below inventory of 2,801 ASF
- Stations - Deviations of ±2 stations: 2
- Accuracy of Classification - No revised use was noted

scheduled lecture/seminar activity conducted in classrooms contained in the inventory. The CSU studies include all scheduled instruction whether lecture, activity or lab, conducted in classrooms and laboratories in the inventory. Therefore, lecture courses taught in laboratories and, to a lesser degree, laboratory offerings in classroom space, are included in the CSU space use data. Therefore, comparisons of space use percentages between the two segments should be avoided without further analysis to ensure comparable data.

2.4 Impact of Room Size on Space Utilization

One question to be answered by this study, related to the technical nature of space and utilization formulas, is the impact of room size on space utilization and space needs during peak hours. Review of room use data can be misleading without looking carefully at the details. Space utilization data prepared by the California State University indicate a somewhat higher number of hours of use per week of rooms with a capacity of 200 or more. However, greater use of large classrooms is usually due to the small number of such rooms available on a campus and the demand. It cannot be concluded that a campus could attain better room use levels by merely adding larger classrooms. We found no evidence that there is a direct correlation between room size and the number of hours per week rooms are used or the percent of stations occupied.

A link does exist, however, between room size and space use which is not related to the proportion of smaller or larger rooms on a campus, but to the match between the size of available rooms and size of course sections scheduled in those rooms. Exhibit

2.4 demonstrates how the degree of match between course size and room size can have a significant impact on station utilization rates. The hypothetical institution presented in this exhibit has more courses in enrollment size range 0-40 than rooms in this same size category based on a scheduling assumption of 36 hours classroom use per week. As calculated in Column 6, the result of this mismatch is that 52 more rooms with 0-40 stations are needed and proportionately fewer larger rooms are needed to match room size with course requirements.

If utilization were not a determinant in estimating space needs, a mismatch between room size and course size would be academic. However, this is not the case. California classroom standards require 53 hours of room use and 66 percent station occupancy. In the above example, the institution is achieving 36 hours per week room use and 63 percent station occupancy. Thirty-six hours per week room use is slightly higher than the 30-34 room use hours found in other states' standards/guidelines (see Exhibit 4.1 on page 44 of the national survey report) and the station occupancy rate is in line with other states' standards. As shown in Columns 7 and 8, application of California's standards would reflect a surplus of 64 rooms.

Exhibit 2.5 demonstrates how the mismatch presented in Exhibit 2.4 affects the institution's station utilization. Courses with smaller enrollments must be scheduled into larger classrooms, resulting in a significant impact on overall station utilization. It is assumed that all rooms which can be matched to course size are matched at 90 percent of capacity (e.g., the average course size for courses in 0-40 size range is 90 percent of the average room size in the 0-40 size category). This is a conservative assumption regarding scheduling prowess and the unavoidable impact of students dropping courses. As shown in Column 7, the resulting impact of the mismatch is the difference between 90 percent and 63 percent station occupancy. Exhibit 2.6 presents a chart depicting the relationship between room use and size match. Unless changes are made to improve the match between course sizes and room sizes, 63 percent is the best possible station utilization.

The situation created by these circumstances is complicated. First, if this institution were a California college or university, no additional rooms could be justified. Based on California's standards, enrollments would have to grow by almost 50 percent before new space could be justified. Also, based on California standards, there are enough rooms of respective sizes to meet space needs. Consequently, it would also be difficult to justify modifying space to improve the match between course size and room size in an effort to improve station utilization.

EXHIBIT 2.4 *Hypothetical Institution Comparison of Actual Rooms vs. Rooms Needed for Class Sizes Under Different Room Use Assumptions*

(1) Size Category	(2) Number of Rooms of That Size	(3) Number of Courses[1] Taught in Those Rooms[2]	(4) Number of Courses with Enrollment of That Size	(5) Number of Rooms Needed Based on 36 hrs/wk[3]	(6) Net Need for Classrooms Based on 36 hrs/wk	(7) Number of Rooms Needed Based on 53 hrs/wk[4]	(8) Net Need for Classrooms Based on 53 hrs/wk
0-40	114	1,711	2,422	166	+52	113	-1
41-60	37	605	185	13	-24	9	-28
61-100	26	326	169	12	-14	8	-18
101-200	16	185	140	9	-7	7	-9
201+	12	159	70	5	-7	4	-8
Total	205	2,986	2,986	205	0	141	-64

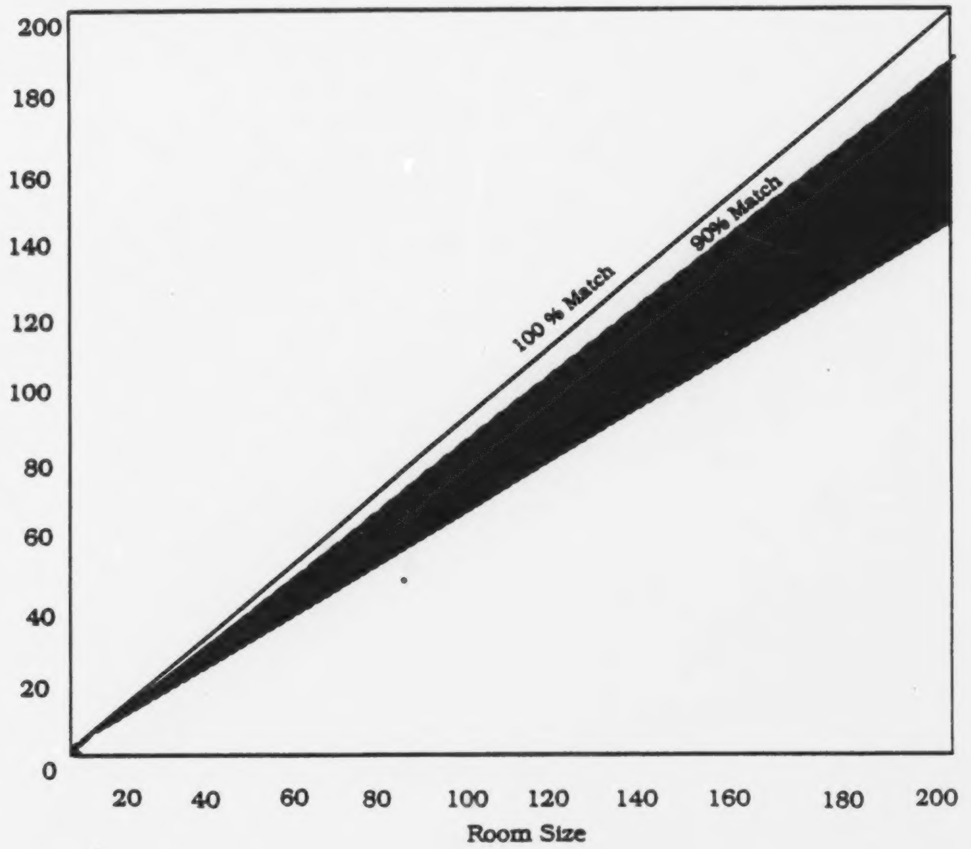
1. Primary and secondary (e.g., lab, discussion) sessions.
2. General assignment classrooms and seminar rooms.
3. Based on the actual average assignment pattern of 14.56 sections per room.
4. Based on actual average assignment pattern adjusted to 53 hours per week room use or 21.44 sections per room.

EXHIBIT 2.5 Calculation of the Impact of Room Use and Size Match on Station Occupancy Rate

(1) Average Room Size Category	(2) Average Number of Rooms of That Size	(3) Room Size (Stations)	(4) Course Size (Stations)	(5) Station Hour Capacity[1]	(6) Station Hours of Instruction[2]	(7) Maximum Station Occupancy
0-40	114	28	25	46,476	41,496	90%
41-60	37	50	45	26,936	17,254	64
61-100	26	75	68	28,392	16,977	60
101-200	16	150	135	34,944	20,238	57
201 and up	12	275	248	48,048	20,602	43
				184,796	116,567	63%

1. Based on actual average assignment pattern of 14.56 sections per room based on 36 hours per week room use.
2. Courses with enrollment 0-40 requiring in excess of 114 rooms of that size available are distributed among larger rooms.

EXHIBIT 2.6 Impact of Match Between Room Size and Course Size



Inability to justify new space or modify existing space may begin to drive curriculum and pedagogy as well as influence recruitment. In this example, even if 90 percent station occupancy could be attained in all rooms, at their current level of room use, the California space use standard could not be met (90 percent x 36 hours= 32.4 hours versus 66 percent x 53 hours = 35 hours). Increasing hours of room use per week would simply shift inefficiency from room use hours to station occupancy since, although rooms would be used more, enrollments would be spread over more available station hours, reducing the occupancy rate.

To improve space utilization, enrollments must be increased and rooms must be filled during some off-peak hours. As a result, core and prerequisite courses may need to be offered at less desirable times to increase enrollments in off-peak hours and, thus, the use of space during these hours. Second, to increase the match between course size and room size and improve station occupancy rates, departments may have to modify teaching methods to offer instruction in larger or smaller sections than desired or in less than optimally configured rooms. Finally, recruitment efforts may need to focus on prospective new students who are willing to take courses during non-peak hours and/or incentives may need to be developed to encourage existing students to attend during off-peak hours.

These actions assume that increasing the supply of educational opportunities will have a direct and proportional impact on space utilization. This is not a valid assumption, however, since the market for higher education is affected by many factors. Demand factors include a variety of issues related to student and instructor preferences. If students prefer to avoid late afternoon classes, for example, they may choose to enroll for an extra term rather than shift their schedules. Other, less controllable factors not related to supply or demand include constraints resulting from institutional mission, student population characteristics, commuting requirements, employment patterns, etc. It may simply not be possible for a campus to increase utilization due to these constraints.

2.5 Use of Space During Off-Peak Hours

Current California classroom utilization standards imply some combination of room and station use to attain overall use of 53 hours per week per room and overall station occupancy of 66 percent during those hours. Many combinations of room and station use can achieve this standard. However, as discussed in the last section, some factors such as the match between room and course sizes, mission, student preferences and other institutional and demographic characteristics can reduce the number of combinations available to an institution. Limiting factors may vary substantially from institution to institution, particularly in a system of higher education as large and diverse as California's. Ability to fill space during off-peak hours is one of the most limiting factors to attaining California's standards. Although some campuses may be more successful than others, overall, space utilization during afternoon and evening hours is lower than morning. In addition, room use on Fridays is lower.

California State University

Exhibits 2.7, 2.8, and 2.9 present a systemwide analysis of California State University classroom space utilization patterns during each hour of the day for the Fall Term, 1987. This analysis indicates that standards are being attained during off-peak periods (course sections beginning at 2:00 p.m. or later.)

University of California

Information for selected University of California campuses, reviewed during the course of our study, also reflected a pattern of reduced room and station use during afternoon and evening hours. However, at least one large, residential campus in the UC system indicated strong afternoon demand due to heavy graduate course offerings but almost no evening demand due to significant extension program activity. As a result, significant room and station utilization extended beyond 2:00 p.m.

California Community Colleges

Although no utilization data was found for commu-

EXHIBIT 2.7 Weekly Room Hour Utilization for CSU Classrooms, Fall 1987 Systemwide

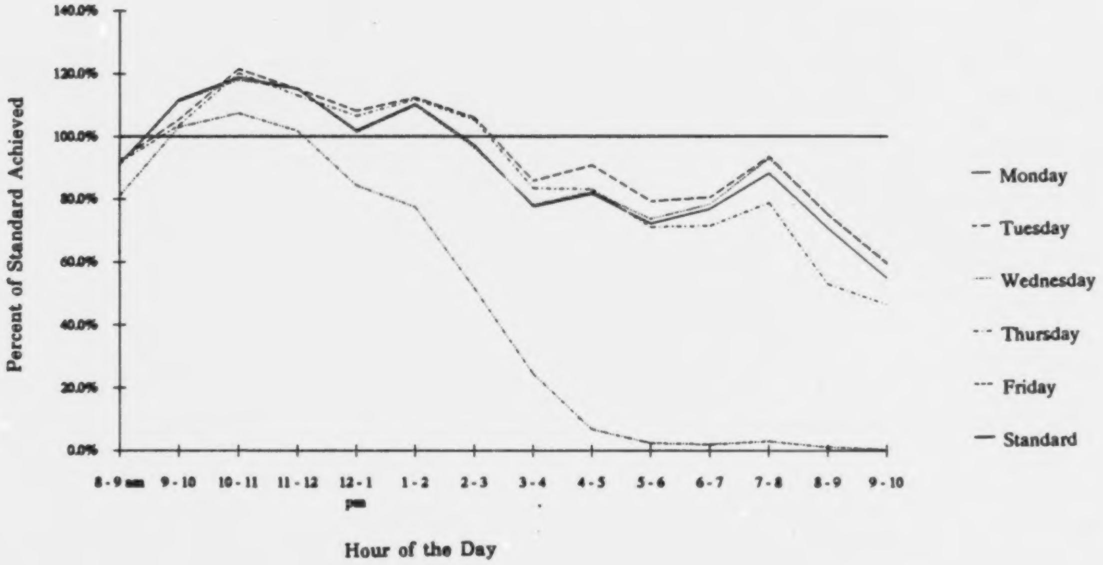


EXHIBIT 2.8 Percent Station Occupancy for CSU Classrooms, Fall 1987 Systemwide

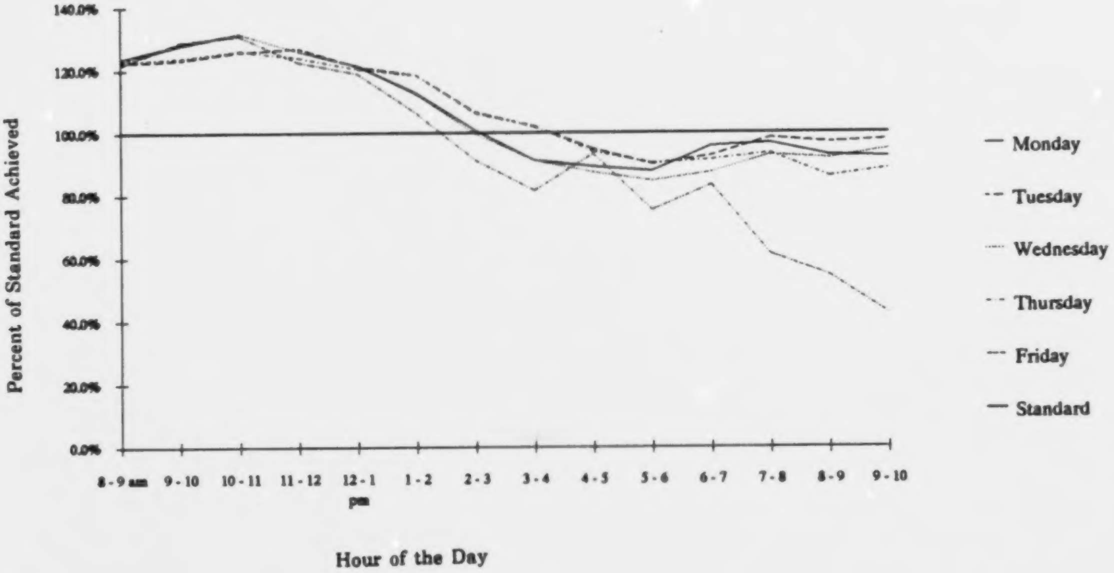
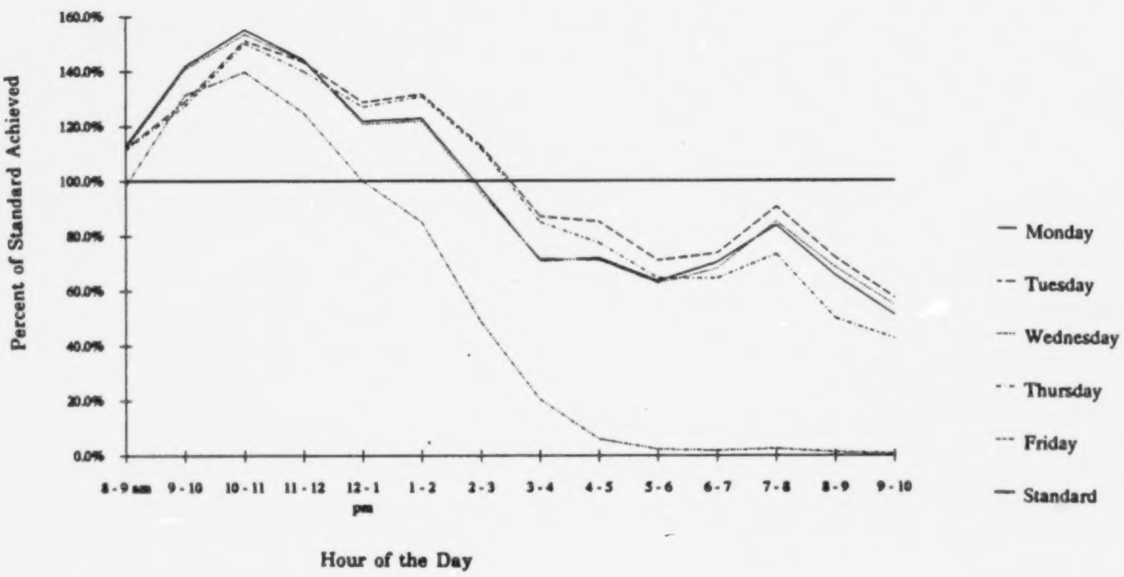


EXHIBIT 2.9 *Weekly Station Hour Utilization of CSU Classrooms, Fall 1987 Systemwide*



nity colleges, representatives from throughout the State indicated during our focus discussion sessions that afternoon room use was a particular problem since colleges often serve two distinct student populations during morning and evening hours. Consequently, meeting the standard from 8:00 a.m. to Noon and 5:00 p.m. to 10:00 p.m. is not difficult, but meeting the standard during the intervening hours is very difficult.

Definition of Off-Peak Periods

Hours included in the definition of off-peak periods are usually determined by circumstances. Most have the morning and early afternoon peak hours as shown in the exhibits. However, as described above for community colleges, some campuses have strong evening programs resulting in a bi-modal morning/evening distribution of courses and attendance patterns.

Factors Affecting Ability to Schedule Classes in Off-Peak Periods

Some of the factors affecting the ability of institutions to schedule lecture classes in the afternoon and evening hours include: ability of students to attend classes due to work commitments, relationship to laboratory sections and demands on faculty time. Concerns have been expressed that off-peak utilization is a self-fulfilling circumstance because of faculty preferences to teach during morning hours Monday through Thursday. In our opinion, such a conclusion oversimplifies a complex phenomenon. Similar utilization patterns found over a wide range of campuses in California and nationally indicate a wide variety of factors, already discussed, contribute to lower levels of off-peak room and station use.

2.6 Conclusions

The information gathered from our site visits supports the following overall conclusions:

Assignable Square Foot Measurements

Although deviations from inventory measurements were observed in slightly less than one-third of the rooms measured in the Community Colleges and on CSU campuses, and in 15 percent of the rooms measured on the UC campuses, the overall differences from inventory were insignificant in each of the segments.

Student Station Count

The number of individual deviations of actual student stations to the number of student stations reported on inventory records was higher than the number of deviations observed in ASF measurements; nearly 50 percent in the Community Colleges and CSU and 17 percent in the University of California. The increased number of deviations observed is due in large part to the ability of students to move chairs between rooms. However, the overall difference in station count was insignificant in all categories of space in each segment with the exception of teaching laboratories in the CSU institutions. In that area, we found an overall deviation of 22 percent or 177 stations above inventory.

Accuracy of Inventory Classifications

Overall, we found the inventory classifications to be accurate in each segment. In some cases, joint use of rooms would allow for different interpretations and in a few cases, inventories had not been updated to reflect recent changes. Ninety-eight percent of the rooms reviewed in the UC sample were classified in accordance with observed use. Ninety-four percent of the CSU rooms visited and 92 percent of those reviewed in the Community Colleges were classified in accordance with observed use.

Congruence with System Level Inventories

We found no differences between local records and system-wide records on the University of California or Community College campuses. In the California State University, we found several campuses which maintain a local inventory, separate from the CSU Space and Facilities Data Base (SFDB). We were informed that recent efforts to update the SFDB would allow elimination of the alternative local records.

Availability of Space Utilization Data

The California State University is the only segment which regularly develops and maintains space utilization data. CSU's centralized data systems support production of utilization information. Neither the University of California nor the Community Colleges maintain the necessary data in a central file. Most of the information needed for space-use studies is decentralized in the community colleges and the University of California. However, we found that space use studies are regularly conducted at the UC campuses we visited for classroom use. We found no examples of complete space use studies at the community colleges.

Impact of Room Size on Utilization

The proportion of smaller or larger rooms on a campus does not appear to affect room or station utilization. However, the match between course size and room size (number of student stations) dramatically affects utilization. In fact, the lack of correlation between room and course size may preclude an institution from meeting State standards. Alternatives to rectify this situation may require an institution to make decisions which are not program or cost effective in order to meet State standards.

Use of Space During Off-Peak Hours

Based on information gathered for this study in California and other states, we must conclude that it is typical to experience at least 4 hours per 14 hour day (8:00 a.m. to 10:00 p.m.) during which utilization falls significantly below standards. In a few cases, logistically constrained, non- or low-residential campuses for example, institutions may only be able to achieve utilization standards during morning and early afternoon hours, falling significantly below standards more than four hours per day. Current California classroom standards which require 67 percent station utilization over 53 weekly room hours require that most State institutions exceed the standards during peak hours in order to offset the lower off-peak utilization.

Several examples of failed efforts to improve utilization during off-peak hours were observed during our review. Programs included offering key courses/ popular instructors during off-peak times, appealing to specific prospective student populations available during these hours, e.g., retired individuals, and offering complete degree or certificate programs during off-peak hours.

2.7 Recommendations

As noted earlier, based on our review, space inventory records are sufficiently accurate and congruent among the segments. Therefore, no changes or improvements are warranted.

Comparable space use data are not currently available. Therefore, we recommend that the Community College system encourage local districts to useexisting data to develop regular studies of the utilization of classroom and laboratory space.

We recommend that the University of California expand the production of consistently defined space use data to encompass teaching laboratories and that regular periodic reports be submitted to the Office of Capital Improvements Planning for compilation and analysis.

We recommend that all segments analyze the degree of fit between room size and course size to identify the impact of mismatches between the two on space utilization and the degree to which the mismatches prohibit the attainment of state standards.

We recommend that the Space and Utilization Standards/Guidelines Advisory Committee carefully assess the current 70 hour per week room availability and the 53 weekly room hour and 67 percent station use assumptions currently used as a basis for determining classroom needs.

3 Changes Affecting Space Needs Since Standards Were Established

3.1 Identification of Discipline-Specific Changes

One need only reflect briefly to recognize that there has been an impact on almost every aspect of education from technological advances in instructional media and automation. There have also been changes in space needs resulting from legislation and regulations concerning health safety, handicapped access and minority/disadvantaged students. Less obvious are discipline-specific changes due to new or modified research techniques, equipment and teaching methods as well as changes in industry or accreditation standards in terms of expectations for graduates.

Phase III of the study was designed to learn about the changes which have occurred since 1955 as they relate to space needs in specific discipline areas to assist CPEC and the Advisory Committee in identifying areas of special need or concern. As in earlier phases, categories of space encompassed in this project phase were classrooms, teaching laboratories, research laboratories and academic offices. Original workplans envisioned individual interviews with faculty and administrators during Phase II inventory and utilization review site visits. Discussion of this approach and an alternative of conducting discussion group sessions with discipline representatives led to a decision that the synergism to be gained from the group discussion approach was preferable. Consequently, a third project phase was added to include 24 group discussions, five in the Community College segment, seven in the California State University, and 12 in the University of California.

Disciplines selected in each segment were as follows:

California Community Colleges

- Arts
- Commercial Services (Food Service, Cosmetology)
- Education
- Engineering and Related Fields (Vocational)
- Sciences

California State University

- Business Administration
- Computer Science
- Engineering
- Natural Sciences
- Performing Arts
- Physical Education
- Physical Sciences

University of California

- Agricultural Science and Plant Biology
- Architecture/Urban Planning/ Environmental Design
- Biological Science
- Chemistry/Biological Chemistry/Chemical Engineering
- Computer Science/Electrical Engineering
- Geography/Anthropology/Demography
- Linguistics/Foreign Languages/Communications
- Performing Arts
- Physical Science, including Mechanical and Civil Engineering
- Psychology
- Social Science/Humanities
- Visual Arts

Each discussion group included six to ten participants comprised of faculty, deans, and/or department chairs from the selected discipline(s) and administrators familiar with California's space standards/guidelines and capital construction process. Discussion sessions typically ran from 10:00 a.m. to 3:00 p.m., including a lunch break. At the beginning of each session, participants were introduced to one another and familiarized with the history and purpose of the study and the specific space standards used in their disciplines. Participants then worked through a prepared outline which helped keep the group on task and ensured that all areas of interest to the study were covered in the time available.

In the following sections of the report, results of the group discussion sessions are presented for each discipline. As is to be expected, some of the observations deal more with how standards are applied on campuses rather than the standards themselves. In addition, many comments are directed toward adequacy of existing allowances.

It is important to note that this study phase did not comprise, nor does it represent, a review of space needs in any discipline. It was designed solely to obtain opinions from knowledgeable sources regarding the types and degree of changes affecting space needs for classrooms, teaching laboratories, research laboratories and academic offices which have occurred since the standards were developed and which are likely to occur in the future. These opinions do not necessarily reflect the opinions of the consultant and are offered to assist CPEC and the Space Standards/Guidelines Advisory Committee identify elements of the existing standards which should be reviewed and issues which must be addressed to develop recommendations to the Legislature for public higher education capital planning space standards/guidelines.

3.2 Overall Findings from Group Discussion Sessions

Group dynamics, commonality of interests among group participants, and the congruity of space needs and key issues among disciplines represented in each discussion session varied widely. As a result, some sessions were more productive than others in identifying issues. However, several issues were raised repeatedly in almost all sessions. These are summarized here to emphasize their importance for the Advisory Committee.

All Space Categories

- The existence of readily available computer capability has affected space needs in all categories.
- Handicap access and related student station requirements have had a modest impact on space not contemplated in the standards.
- Current standards do not include a method for projecting student study space outside of the library and for self-paced instruction.

Storage and Support Space

- Technologically advanced equipment usually supplements rather than replaces old equipment due to instructor preference, inventory system requirements or simply because the old equipment performs some operations better than the new. Therefore, storage space needs have increased with new technology even though equipment might be smaller.
- Operating budget allowances and lower prices encourage acquiring state-of-the-art equipment but required set-up and storage space constraints limit actual acquisitions.
- Number of courses taught in alternating semesters has increased, increasing the storage space needed since existing space must now support more courses.
- Increased use of computers has required the need for more support staff and shop space.
- The increased use of instructional aids and a more "hands-on" approach has increased demand for both storage and shop space.

Classrooms

- Increased emphasis on research in CSU has resulted in pressure to adjust teaching load requirements or teach larger classes for more concentrated teaching unit credits, generating "release time" for research. Shortage of larger classrooms and inability to justify new space based on current standards results in space driving program decisions.
- Substantial increases in the use of film, video tape, in-class demonstrations, and interactive computer instruction have increased the need for media support space.
- Interactive use of lap-top or built-in computers will increase space needs in the future.
- There has been increased emphasis on teaching application skills as opposed to theory. This has served to increase emphasis on lab work and to mix lecture and lab instruction resulting in less distinction between the two.

Teaching Laboratories

- The increased emphasis on application rather than theory has resulted in more experiments conducted and more scheduled and self-instructional laboratory time being required than in the past. This results in students requiring more station hours.
- Need for unscheduled, self-paced learning time is increasing, i.e., self-paced computer instruction. Although standards include station size assumptions for computer labs, there is currently no formula for generating space for self-paced instructional labs.
- Work-in-progress, particularly in the arts and sciences at the upper division is larger and more complex, requiring more space than in the past.
- Specialized equipment now measures results at narrower tolerances. Some of this equipment requires dedicated, specialized lab space not needed in the past.
- Health and safety requirements have increased space needs for storing, handling, and disposing of hazardous materials.

Research Laboratories

- Research team composition varies widely among and within disciplines, making a "research unit" concept for space allocation problematic.
- Increased emphasis on the research function for CSU indicates need for more than an informal research space standard.
- Undergraduate involvement in research is becoming more common. Current standards only provide space for graduate level research students.
- Recognition of only State-funded staff excludes a growing number of postdoctoral fellows.

Academic Offices

- Most faculty have personal computers. In the future, these are likely to be tied to central information systems for recordkeeping, word processing, demonstration, instruction, etc. A personal computer/work station, printer and other peripheral equipment and supplies requires more office space than a typewriter.
- Board of Trustees policy to provide single faculty offices for CSU full-time instructors will raise the issue of how to accommodate existing space in estimating future needs.
- The standards do not provide space for emeriti and visiting faculty The importance of these persons and their contribution to the mission of colleges and universities is therefore not recognized in current standards.

3.3 Results of Discussion Groups in Specific Disciplines

In the following sections, suggestions made by participants in discussion groups are presented for selected disciplines.

The California Community Colleges

FINE ARTS

The disciplines represented at the art discussion group were dance, music, photography and art. Existing facilities planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Classroom	43	15
Class Lab	257	60
Office Space (ASF per FTE faculty)	N/A	85

Factors Affecting Instruction

Lab vs. lecture/application vs theory: In response to industry pressures, the community colleges are attempting to teach more critical thinking concepts in performance courses. However, the necessary lecture facilities are not available and they have been unable to make that transition. On the other hand, for art classes, it is most efficient to use lab space for lectures because there is a demonstration component which must accompany the lecture. The best lab/lecture mix in this area is approximately 20 minutes of lecture and then the "hands-on" experience.

For classes such as beginning acting, the maximum class size should be between 10 and 12 students. In this area it is difficult to distinguish between lab and lecture.

Need for media support in most classrooms: Classes in art history are taught with dual projectors and dual screens. These classrooms, as well as those used by music and photography, require full media support at all times.

Classroom support space needed: Classroom support space is necessary for a variety of reasons. All art classes require preparation time before classes and they cannot prepare for one class while another is in session. Consequently, preparation facilities are needed adjacent to classrooms. Storage space for chemicals used in photography is also necessary.

Utilization/scheduling problems: Discussion group participants indicated that there was a great deal of difficulty in scheduling classes between 1 and 5 p.m. The general perception is that the students who attend community colleges are not full-time students, but rather are working to support themselves and going to school simultaneously. Classes scheduled between 7 a.m. and 1 p.m. and between 5 p.m. and 10 p.m. will be full and every available room will be used, while classes scheduled between 1 and 5 will not be full. Some campuses have indicated that non-capacity space (e.g., library, LRC) is used intensively during the off-hours. Other campuses are virtually empty during that period.

The type and availability of space is driving the curriculum. For example, a class with a maximum enrollment of nine students would probably not be approved because it would not efficiently utilize the limited space available. However, if it was decided to increase the class size, the instruction would not be effective.

Instructional Space Requirements

Unscheduled labs and work-in-progress: The nature of studies in the arts is such that students must spend a great deal of time working on projects outside of class time. This means that there must be practice rooms available for musicians as well as studios for painting, sculpture, dance, etc. One problem for disciplines such as painting and sculpture is storage of, and access to, work in progress. In order for students to be able to finish those projects, they must have access to the room in which the course is scheduled since these projects cannot readily be moved around. This means that the rooms must be unscheduled part of the day. In some cases an instructor MUST be present in unscheduled labs. This activity, however, generates no contact hours and the space is shown as unused.

Changes in technology do not replace old equipment: New equipment in many areas does not supplant the old, but rather adds to it. For example, in photography, two developing labs are now required, color and black and white; in music, students learn piano and synthesizer keyboard and ear training is now done by computer. In printing, computer equipment is now widely used in typography, desktop publishing, and layout. However, old equipment is still in wide use in the industry and students also need "hands-on" experience with that type of equipment. Computers have been added to almost every aspect of the performing arts, but as augmentation, not replacement. Consequently, space needs are increasing.

Multiple use of labs is difficult in the arts: Designing and utilizing multiple-use labs is difficult in most areas of the arts, resulting in many specialized or oversized labs. Ceramics labs are dedicated because the labs are too dirty for anything else. Photography labs (studios, darkrooms) cannot be used by any other discipline. In some schools, the metal sculpture lab is combined with wood sculpture, but the equipment takes up most of the space. There is also a safety consideration which governs use of that lab for any other class, because the equipment is dangerous. The dance studio must also be dedicated only to that use because the special floors must be protected.

Storage space needs: In order to maintain a breadth of courses, some classes are taught every other semester. The materials for that class cannot be stored in the lab during an "off" semester, because the space is insufficient. As a result, these materials are being stored in faculty offices. Additional storage space is needed for these materials.

Academic Offices

Office space is inadequate: The discussion group felt that faculty office space was inadequate given the range of uses the space must fulfill. An office of 110 square feet for one person was considered to be reasonable. Currently, part-time and emeriti faculty do not have office space. About half of the full-time faculty share office space with part-time faculty. The ratio of part time to full time is 3:1 on a headcount basis.

Faculty workroom needed: For grading purposes, about 25 drawings a day need to be spread out at the same time. The offices cannot accommodate this need and the faculty do not have workrooms available.

These workrooms could also be used for conferences with two or more students when there is a need to have demonstration materials available.

Computers: Computers require more space than typewriters. An effective computer station consists of a monitor, computer, keyboard, and printer. Some instructors have additional sound equipment wired to their computers for teaching computer-generated composition.

Summary

- Fine arts courses tend to be more oriented towards critical thinking today and therefore require more lecture space.
- Art classes are most appropriately taught in labs so that the transition from lecture to activity can be made easily.
- Media equipment is used extensively in the Art discipline.
- Support space is needed for storage of projects and equipment.
- There are scheduling problems for afternoon classes due to the high number of working students.
- Art students spend a great deal of time in unscheduled labs. There is a need for practice rooms for music and studios for art.
- Labs used for art courses usually need to be dedicated labs.
- Office space is felt to be inadequate. It was suggested that 110 ASF per faculty member would be sufficient. Computers are used now and take up room in the office.
- It was also suggested that a faculty workroom is needed for conferences and for storing demonstration materials.

COMMERCIAL SERVICES

The disciplines represented at the commercial services discussion group were: cosmetology, food services, hotel management, and travel/tourism. Existing facilities planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Classroom	43	15
Class Lab	214	50
Office Space (ASF per FTE faculty)	N/A	85

Factors Affecting Instruction

Responsiveness to community needs: The community colleges see themselves as tied closely to the community and consequently try to be responsive to community instructional needs. The courses offered in commercial services attempt to reflect current community needs.

Additionally, for many immigrants, community colleges are the way to obtain needed language and job skills to become employable. The effect on the community colleges is an increase in explanation and demonstration times while teachers struggle to overcome language barriers.

Utilization/scheduling problems: As with other disciplines, commercial services faces a problem with respect to scheduling afternoon classes. Conducting classes with low enrollments, as many afternoon classes have, brings down the student/faculty ratio and stations are shown as underutilized. Also, if a course is scheduled, but does not meet enrollment criteria, the course is canceled. Since the time a course is scheduled significantly influences its chances of survival, time periods are selected when enrollment will be sufficient to offer the class.

Instruction Space Requirements

Changes in Board of Cosmetology requirements: In cosmetology, the State Board now requires pedicures as part of the program, so space is required to perform pedicures. While areas of cosmetology are becoming specialized, space needs continue to increase because everyone needs to learn about all branches of the profession to pass Board certification.

Variety in curriculum demands: The culinary arts program varies dramatically in lab/lecture mix. In the first year, students spend four hours in the kitchen and two hours in lecture; by the third year the program is entirely lecture with no kitchen labs.

Changes in equipment: In culinary arts, the advent of the microwave and convection ovens has resulted in a need for more space because these pieces of equipment augment, but do not replace, conventional ovens.

Hotel management requires students learn to use the specialized software most hotels now use for their reservation and accounting systems.

In cosmetology, the number of implements used has increased, as well as the need for pedicure chairs. False nail and nail enamel toxics require air circulation space areas. Yet the large hair dryers are still used and require considerable space.

Academic Offices

Full-time/part-time faculty: The ratio of full-time faculty to part-time faculty is 1:2. Part-time faculty do not have offices but are required to hold office hours. Office size is inadequate for meeting with students.

Computer support: Generally the faculty do not have their own computers. One community college has a faculty computer lab which is part of a classroom. The computers are used to make lists, keep letters and grades, etc. This arrangement leads to security problems because students have access to the room. A separate, faculty only, computer room is needed.

Summary

- Due to the increasing number of foreign students, explanation and demonstration times have increased in order to accommodate those students who are not proficient in English.
- Scheduling afternoon classes is difficult due to the increase in the number of working students.
- In cosmetology, the State Board has increased the degree requirements, which means an increased need for instructional space.
- Changes in equipment for the various commercial services disciplines has brought about an increased need for instructional space and storage space.
- Offices are not large enough for meeting with students, but are felt to be adequate otherwise.

EDUCATION

The disciplines represented at this discussion group were child development, health education, and physical education. Existing facilities planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Classroom	43	15
Class Lab	321	75
Office Space (ASF per FTE faculty)	N/A	85

Factors Affecting Instruction

Increased interest in the fields: The field of physical education is experiencing an increase in enrollment due to an increased interest in health and fitness. Traditionally, students enrolled in physical education courses were college-age and enrollment tended toward courses such as tennis. Now, people of all ages and levels of health (smokers, overweight, etc.) are enrolling, and the most popular courses are aerobics and weight-training. This increases the need for safety precautions as well as the amount of indoor laboratory/activity space needed for successful instruction.

Child development faculty expect that the changes in society and resulting increases in the need for child care will cause an increase in the demand for child development courses. The efficiency of a child development program hinges on the existence of a child care center on campus for the students to get "hands-on" experience. The question arose whether such child care centers, if staffed by child development students, could be considered lab space.

Lab/lecture mix: The discussion group indicated that their fields are experiencing an increase in "hands-on" learning. The distinction between lab and lecture is becoming more vague as the two are combined in teaching practice. Introductory classes tend to be largely lecture, but after that, the lab becomes very important.

Media support: The use of films in classes is declining as the use of VCRs increases. Additionally, instructors videotape students so the student is able to observe his or her own performance. Classrooms should have permanently installed monitors. Otherwise, to view the videotape, someone needs to go get the monitors and bring them to the classroom; this requires set-up and take-down time. The group expressed security concerns over leaving the monitors in the rooms unless they were permanently installed.

Observational needs in child development: The nature of child development courses is such that the rooms for the children need to be large enough for the students to be in the room to observe the children. Ideally, there should also be one-way mirrors so that if a parent is observing his/her own child, the child will not be aware of the parent's presence.

Factors Affecting Space

Physical education labs generally require large rooms, often with a great deal of equipment in them. A complete physical education program, for example, would have the following labs: circuit weight training; cardio-vascular lab; aerobics; strength lab; and a fitness testing lab. Each lab has specialized equipment and the labs are generally supervised, but unscheduled. This creates a situation with actual contact hours, but no scheduled time for students in the labs.

Influx of foreign students: The increasing number of non-English speaking and students with English as a second language necessitates smaller groups for effective instruction.

Academic Offices

Office space: Most part-time faculty do not have offices. Depending upon the campus in question, many full-time faculty have to share their offices. Some faculty office walls do not go all the way to the ceiling and others use partitions as a way to save space. The fundamental problem with both of these is a lack of privacy.

Computers: The discussion group felt that current offices were not large enough to accommodate all the things they need in an office: desk chair, files, bookcases, an extra chair and a computer. Between 25 and 40 percent of the faculty have computers. Additional space is needed to allow faculty to do their work and meet with students.

Summary

- There has been a recent increased interest in the physical education fields and enrollment is growing for these courses.
- The recent changes in the structure of the family have produced a greater emphasis on child development courses. An on-campus child care center is needed for students to gain experience.
- There has been an increase in the laboratory component in the education fields due to the emphasis on a "hands-on" approach to learning. Lab and lecture experiences are becoming more and more combined.
- VCRs and monitors are frequently used to aid the instructional process.
- Storage space is an important issue. Equipment must be securely stored when not in use.
- Courses need to be smaller in class size due to the influx of foreign students with English as a second language.
- Office space is not large enough to contain the necessary equipment and furniture. Part-time faculty do not receive office space.

ENGINEERING AND RELATED FIELDS

The disciplines represented at the discussion group were construction, automotive technology, avionics, electronics, printing, and drafting. Existing facilities planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Classroom	43	15
Class Lab	321	75
Office Space (ASF per FTE faculty)	N/A	85

Factors Affecting Instruction

As with other disciplines, the engineering fields have trouble filling afternoon classes. One of the participants indicated that an unsuccessful attempt was made in 1975 to fill afternoon classes by offering the most popular courses with the most popular teachers. Another participant indicated they have moved an entire discipline (automotive) to afternoon and evenings only. This change is still being evaluated.

Lecture/lab: For most of these disciplines, the lecture must take place in the lab environment. In these disciplines, there is twice as much lab experience as lecture.

Increase in equipment: Labs are becoming more equipment intensive and require more one-on-one instruction, supervision, and assistance.

Security factors affect support space: In some disciplines, particularly in automotive technology, there is a need for a large number of specialized tools and equipment. Some pieces of equipment are very expensive and need to have a self contained, lockable tool room.

Instruction specialization increasing: The increase in specialization is resulting in an increase in equipment used in the labs. For example, drafting used to require a table and chair. Now schools need space for a table, chair, computer, digitizer, plotter, and printer. In automotive technology, labs must contain the same table used 15 years ago plus an analyzer, diagnostic computers, and electronic torque wrenches. The same is true for auto body courses. Uni-body construction and new painting systems have dramatically impacted the space requirements for body work. Cars now require three coats of paint where previously they required just one, tripling the time in the paint booth. When the car fender on an older model car was dented, the fender could be removed and taken to a work bench for repairs. Uni-body construction means that that is no longer possible. The entire car must be in a space where the mechanic can work on it.

Similar situations have occurred in printing, furniture making, and electronics/avionics. Specialization only serves to increase the amount of equipment and space needed.

Further complicating the specialization problem is the feeling among instructors that students are coming to the community colleges with less technical experience than previously, which increases the amount of explanation and instructional time necessary.

Undergraduate Instruction Space Requirements

Some confusion exists at the community colleges in how to determine the number of students per station in some courses. Depending on the type of instruction occurring, between two and nine students can work at one station. This seems to be especially true in avionics and automotive technology classes.

Storage space: Increasingly strict standards surrounding use and disposition of hazardous materials means that many standard supplies (oil, freon, printing ink) need to be stored in containers until the hazardous waste is picked up. Hazardous waste storage areas are therefore needed.

Many of the automotive and diesel technology programs have new cars and state-of-the-art equipment donated to them. Secured storage areas must therefore be provided.

Academic Offices

As in other areas, part-time faculty do not have offices and many full-time faculty share offices. Office space is generally inadequate to permit teachers to meet with students in the offices. The participants indicated that their offices need space for teaching aids, a personal library, and a work table or additional work space.

For engineering related fields it is important that the offices be adjacent to labs and not clustered together separate from the labs.

Summary

- The engineering discipline also has trouble filling afternoon classes due to the increased number of working students.
- Lecture often needs to take place in a lab environment in order to combine the instruction and activity components of the course.
- Labs are becoming more equipment intensive. Many pieces of equipment need to be stored in a secure storage facility.

- The need for specialization of the labs is becoming more apparent as the type of equipment and experiments broaden.
- Office space is not large enough for meeting with students. There needs to be room in the offices for teaching aids, personal libraries, and a work station.

SCIENCES

The disciplines represented at the discussion group were biology and physics. Existing facilities planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Classroom	43	15
Class Lab		
Biological Sciences	235	55
Physical Sciences	257	60
Office Space (ASF per FTE faculty)	N/A	85

Factors Affecting Instruction

Unscheduled/scheduled labs: In biology, the colleges are moving toward more unscheduled lab time, allowing the student to complete the experiment at his or her own pace. This also facilitates make-up labs. The movement toward supervised unscheduled labs has resulted in an increased reliance on VCRs and monitors. The students watch a tape of how to conduct the experiment rather than the instructor explaining to each student how to set up the experiment. Consequently, the labs need to have VCRs and monitors in them at all times.

Set-up and preparation: The increase in the complexity of the equipment and more stringent hazardous waste safety requirements results in an increase in the set-up time necessary for labs. The group felt that the amount of time allowed between labs is not sufficient for the amount of set-up needed.

Classrooms need better support facilities: Effective lecturing in the sciences requires a great deal of equipment. The front of the classroom must be equipped with electrical outlets, a sink and hookups for air hoses. Additionally the use of computers and laser disks is increasing. They are used as demonstration tools to help the student understand things that cannot be drawn effectively on the blackboard. Video tapes are also being used in the sciences. This impacts classroom instruction because the computers, laser disks, VCRs, and monitors need to be set up and readily available. Optimally, a storeroom between each two classrooms for storage of media equipment and demonstration chemicals and equipment would be appropriate.

Factors Affecting Space Requirements

Increase in volume of equipment: The number of pieces of lab equipment has mushroomed. In biology for example, the labs previously had only one microscope per lab. Currently each lab station has a microscope. Additionally, labs now have, as standard equipment, a full size autoclave, spectrophotometers, fraction collectors, physiographs, automated dispensing machines, and incubators and refrigerators. The new equipment in the physics labs includes air track carts, oscilloscopes, circuit training boards, lasers, interferometers, and frequency generators.

Station configuration: The stations need to be large enough to accommodate up to four students in one station. The surface area needs to be long enough to also accommodate a computer for data collection purposes, and an area for the students to write up experiment results. In addition, each lab should hold reference books.

Hazardous waste containers: Hazardous materials used in experiments (blood, urine, microbes, and some chemicals) need to be stored until the contracted waste collectors come. A total of at least five square feet is needed for storage of those containers.

Academic Offices

As with other disciplines, most of the part-time faculty in the sciences do not have offices. The full-time faculty need to have room for the following: desk, two chairs, file cabinet, bookshelf, and a telephone. Many instructors also have computers, now kept at home which is where they do most of their work.

Summary

- There has been a recent movement towards more unscheduled labs. Labs use VCRs and monitors to instruct students about the experiment.
- The set-up time for labs has increased due to the amount and complexity of the equipment used. Storage space needs have also increased. Special storage areas must be provided for certain chemicals and materials.
- Classrooms need to have better support facilities for the equipment which is used during the lectures.
- Lecture time has increased recently.
- Lab stations need to be large enough to accommodate up to 4 students in one station.
- Office space is felt to be inadequate. Part-time faculty receive no office space.

The California State University

BUSINESS

The business discipline includes the subject areas of general business, finance, accounting, and marketing. Existing facility planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Lower Division		
Classroom	43	15
Class Lab	321	75
Upper Division and Graduate		
Classroom	43	15
Class Lab	321	75
Office Space		
FTE faculty	N/A	85
Administrative allowance		33/faculty FTE
Support Space	Allowance of 7% of total of above categories	

Factors Affecting Undergraduate Instruction

Characteristics of the business discipline today: The recent trend has produced a definite decrease in the proportion of full-time students. The discussion group participants noted that the decrease in class availability and increase in the number of part-time students means that there are now more students, taking fewer credit hours of class. Business courses currently focus more on work-oriented classes rather than on theoretical lecture classes.

Limited use of labs: Although there are very few scheduled teaching labs for the business discipline, the point was made that if more labs were available, they would be used. Research, salesmanship, and writing are most appropriately taught in a laboratory setting. More technicians are needed in the labs to support the students and to manage the equipment.

Use of computer/media support: Computers have made an immense impact on the business discipline. The ideal situation would be to have all classrooms equipped with computers with media equipment available to project images generated on the computer screen.

Undergraduate Instruction Space Requirements

Classroom space should be flexible: Classrooms tend to vary only by size and type of course. The group stressed that flexibility was the main issue regarding classrooms -- the rooms need to be adaptable to the particular activity taking place. Larger desktops are needed (or accounting tables) for holding class materials, textbooks, and a PC.

Graduate Instruction

Emphasis on lecture and discussion: In graduate-level business courses, lecture and discussion make up the majority of the instruction time. All labs are unscheduled; there are no formal labs for graduate students.

Increased need for graduate facilities: There are very few seminar rooms or rooms for independent research. Space is needed for rooms in which graduate students can confer with faculty. Student service facilities such as a career planning center are also needed.

Support Space

Increased need for auxiliary space: Of particular concern is the need for storage space for equipment. There also needs to be space provided for conference rooms, studios, support staff, and student services.

Research Programs

Increased pressure to research: The discussion group participants commented that there was a distinct pressure felt by the faculty to conduct research and publish. However, most research must take place in the faculty member's offices due to limited space available to support research activities.

Academic Offices

Students frequently meet with faculty in their offices: Faculty offices need to have space for instructors to meet with students. Marketing students in particular often meet in groups of several students at a time. In addition to accommodating students, space is needed for bookcases, file cabinets, a computer table, and a desk. Approximately 40 percent of the faculty share office space, which decreases the space available for meeting with students.

Summary

- Labs are not used extensively in the business discipline, partly due to the fact that few lab facilities are available.
- Computers are being used more and more in business courses. Ideally, all classrooms should be equipped with computers.
- The most important point made regarding the instructional facilities was that classroom space needs to be flexible in design to facilitate use of teaching aids.
- Graduate business courses tend to focus on lecture and discussion. For graduate students, more facilities are needed such as meeting rooms for seminars and independent research.
- The need for support space is a major concern. Space is needed for storage and for support staff.
- Faculty sense an increased pressure to conduct research and publish.
- Office space was felt to be inadequate for meeting with students and for housing the necessary equipment and furniture.

COMPUTER SCIENCES

Computer sciences are commonly referred to as either "computer engineering" or "computer science." Existing facility planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Lower Division		
Classroom	43	15
Class Lab	210	49
Upper Division and Graduate		
Classroom	43	15
Class Lab	78	49
Office Space		
FTE faculty		110/FTE
Administrative allowance		30/faculty FTE
Support Space	Allowance of 5% of total of above categories	

Factors Affecting Undergraduate Instruction

Changes in the computer science discipline: Focus group participants noted that computer science is a rapidly changing field. They felt that space is needed to keep up with the constant changes which are occurring. The Computer Science Accreditation Board (CSAB) has increased the required units to the State maximum of 132 units. Due to the increase in the number of part-time students, the normal length of time to complete a bachelor's degree is between 5 and 6 years.

Emphasis on laboratory experience: Several schools have moved away from lecture and towards more labs, while other schools do not have scheduled labs and therefore focus on a lecture approach. The participants agreed that the ideal is a lecture/lab combination. Teaching assistants are used to monitor the labs, but there is no space allocated for these assistants to supervise the labs. The optimum lab class size is 20 students.

Use of unscheduled labs: It was felt that students should gain experience on the computers during self-paced labs, not during lecture. Open labs are also used for completing senior projects, which are usually team projects. Although these labs are unscheduled, they do require faculty assistance.

Increased use of computer/media support: The computer equipment used is constantly changing. For example, Sun computers are being used more frequently and Vax are being used less frequently. The Suns have larger screens and have a mouse attachment, so they require more space The discussion group participants felt that portable computers were needed in each classroom and that an overhead projection of the computer screen is also necessary.

Undergraduate Instruction Space Requirements

Classrooms need to be larger: Current budgeting formulas generate student assistants when class size exceeds the prescribed student/faculty ratio. However, since large classrooms are not available, it is not possible to take advantage of the high student demand to balance out the classes with a lower demand. Therefore the group felt that more large rooms are needed.

Increased laboratory size allowances needed at the upper division: Advanced work stations require more space since the equipment tends to have larger footprints. Printers occupy a large portion of space as well. The focus group participants felt that the required ratio of printers to students is between 1:4 and 1:6. This ratio increases for scheduled labs and decreases for unscheduled labs. One problem mentioned was that the monitors can obstruct the students' ability to observe what is happening. The labs also need space in which to lay out printouts and hold discussions. The necessary furniture includes tables and cabinets for documentation. It was noted in the discussion that more team projects are taking place because the industry has more project applications. An additional point made was that there is an increased need for dedicated lab space in computer sciences due to more sophisticated equipment.

Graduate Instruction

Insufficient space for graduate assistants: Graduate students are used as teaching assistants, but adequate space is not provided for them. Typically, three to four TAs share a desk. The focus group participants mentioned that faculty FTEs are split up to pay for graduate assistants. These assistants receive faculty contact hours, but they do not generate space for each position. This situation adversely impacts space allocations.

Support Space

Increased need for auxiliary space: The computer science discipline has an increased need for support space to house computer equipment and accompanying software. The participants felt that in the future there will be more of a need for common space for interaction and for equipment used in research Another trend of the future will be the need for more support staff and facilities to house them. Generally, computer courses associated with engineering are allocated space for a shop, while other courses are not allocated such additional space.

Increased need for security: Because of the expensive nature of the equipment and software used in the computer science discipline, security of the storage facilities is an important issue.

Research Programs

Increased pressure to conduct research: The discussion group participants had varying opinions regarding research. Some faculty feel there is a definite pressure to conduct research. Others do not feel a significant research emphasis. When research does take place, it is usually conducted in faculty offices. If students are used to assist with research, it is considered teaching and not research.

Academic Offices

Faculty offices need to be larger: the faculty agreed that most of their working time is spent in their offices because that is where their equipment is stored. The offices need to have space for an advanced work station, a printer, communication cables, and a desk and table. The participants felt that they were not receiving the standard of 110 ASF/FTE. The consensus was that 130 ASF/FTE would be sufficient.

Summary

- Computer science is a very dynamic field. The discussion group participants agreed that additional space should be made available in order to keep up with changes in the discipline.

- The ideal teaching environment for computer science courses is a mixture of lecture and lab experience.
- Unscheduled labs are used for gaining computer experience and for working on team projects. Even though these labs do not generate teaching units, faculty must be present during the labs.
- There should be more classroom space for the computers and media equipment.
- Laboratories need to be larger, particularly in the upper division, in order to accommodate lab equipment and activities.
- Graduate assistants are not allowed adequate space in which to work.
- Support space and security are becoming increasingly important issues as the amount of equipment and software increases.
- The discussion group participants did not feel that 110 ASF/FTE was adequate for faculty office space. They felt that 130 ASF would be more appropriate.

ENGINEERING

The engineering discipline includes the subject areas of mechanical, industrial, chemical, aeronautical, and civil engineering. Existing facility planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Lower Division		
Classroom	43	15
Class Lab	385	90
Upper Division and Graduate		
Classroom	43	15
Class Lab	625	110
Office Space		
FTE faculty		110/FTE
Administrative allowance		40/faculty FTE
Support Space	Allowance of 15% of total of above categories	

Factors Affecting Undergraduate Instruction

Changes within the engineering discipline: The field of engineering has changed dramatically over the past several decades. When the space standards were set in the 1950s, computer and electronic classes were only in the early stages of development. The engineering labs in particular have seen significant changes in structure. Participants of the discussion group predicted that instruction methods will change in the future to include an expanded use of work stations, video information systems, and networking. In addition, there will be less of a distinction between lecture and lab as the two activities become more and more combined. It was also noted that there is a growing emphasis on innovation and design. The curriculum is changing to include more breadth of coursework and less specialization. More students are taking five or more years to complete their degree due to curricula expansion as well as an increase in the number of working students.

Emphasis on laboratory experience: The emphasis today in the engineering discipline is a "hands-on" approach to learning, so lab experience is emphasized. As the equipment used in the engineering labs becomes increasingly sophisticated, more time must be spent in the lab in order for the students to have more contact with the complicated equipment. In addition, instructors are having to spend more time with the students due to the current "hands-on" approach to learning.

Trend towards the use of more unscheduled labs: Unscheduled labs are necessary so that students may access the equipment as necessary. During these unscheduled labs students may work at their own pace to become familiar with the equipment.

Increased use of computer/media support: Computers and media equipment have had a significant impact on the engineering discipline. The discussion group participants predicted that the future will see an increased use of video and computer-aided instruction and self-tutoring programs. Although many students have computers at home, they generally do not have the appropriate software and therefore must use the computers on campus. Videos are used in the labs to demonstrate the use of equipment to help the students prepare for the lab experiment. Data are now collected electronically instead of being manually recorded.

Undergraduate Instruction Space Requirements

Need for larger classroom facilities: The discussion group participants brought up the point that there are very few large classroom facilities available, so it is not possible to have large classes even though they are needed.

Need for more lab space and for more dedicated labs: The industry now requires students to have more applied experience, so there is a need for more lab space for student experiments. Current lab facilities have limited storage space available in the labs for equipment. In addition, the equipment used is larger today than in the past. For safety purposes, the labs need to have space in excess of the area that the equipment physically occupies. In addition, there is no space in the labs for team projects. Approximately 50 percent of the engineering labs need to be dedicated due to the safety restrictions regarding the use of the particular equipment.

Graduate Instruction

Increased need for dedicated lab space: There is also a need for specialized laboratories for graduate courses. Equipment used in certain labs may not be readily moved or may need a controlled environment in order to operate properly.

Need for graduate student space for unscheduled activities: A major problem discussed by the group was the issue of a lack of space for graduate students to conduct research, to work on projects, and for unscheduled laboratory time.

Support Space

Increased need for auxiliary space: The participants felt that the formulas used to calculate the space standards do not take into account the substantial equipment needs in the high tech fields. In addition, there needs to be space for a work area for the lab technicians and space for storing student projects. Other necessary support facilities include specialized centers for applied research, seminars, and demonstrations.

Research Programs

Increased pressure to research: The discussion group participants felt that there is a definite pressure for faculty to conduct research, but the standards contain no allowance for this purpose and instructional labs therefore must be used for conducting research.

Academic Offices

Faculty offices: Faculty offices need to have enough space to house an advanced work station (containing a computer and printer), file cabinets, and extra chairs for two to three students or faculty to meet with the instructor.

Lack of office space for visiting faculty: Visiting faculty, adjunct professors, and emeriti share existing office space. No additional space is provided for them.

Summary

- The engineering discipline has changed significantly since the 1950s. The emphasis on innovation and design means that the labs are becoming an increasingly important element in the engineering curriculum. Space allowances need to reflect the current needs of the discipline for lab space.
- Computers and media equipment have greatly impacted the discipline. Videos and computers are used in the labs to aid student instruction and for data collection.
- Large engineering classes cannot be scheduled since there are few facilities available which can accommodate large classes.
- In addition to needing more lab space due to the current emphasis on laboratory experience, safety and security factors require that many engineering labs be dedicated to a specific purpose.
- Graduate students need to have space in which to conduct research and work on projects.
- Additional support space is needed to house lab equipment, student projects, lab technicians, and other support facilities.
- The discussion group participants felt a definite pressure to conduct research, but the standards provide no allowance for research space.
- Faculty office standards should be increased to accommodate a computer and printer, file cabinets, and two or three extra chairs for group discussions. Space is also needed to house visiting faculty.

THE NATURAL SCIENCES

The natural sciences are commonly referred to as "biological science." Existing facility planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Lower Division		
Classroom	43	15
Class Lab	235	55
Upper Division and Graduate		
Classroom	43	15
Class Lab	341	60
Office Space		
FTE faculty		110/FTE
Administrative allowance		35/faculty FTE
Support Space	Allowance of 10% of total of above categories	

Factors Affecting Undergraduate Instruction

Increased wet-lab instruction: There is a growing trend towards a practice orientation in the natural sciences. More dedicated labs are reserved for lengthy biological processes which have replaced the slides and samples of the past. Many of these complicated experiments utilize electronic digital equipment which did not exist when the standards were established. In addition, computer workstations are now used to record data from experiments and simulate experiments.

Increased use of visual aids/media support: Both students and faculty need to have ready access to visuals. In the past, this has been in the form of slide collections. This visual experience sometimes required demonstration tables and preparation rooms. Compact disk technology, in conjunction with computers, is likely to provide the necessary visual examples both in the classroom (through monitors) and in resource centers in the near future.

Shift from natural history to biology or chemistry: DNA biosystem studies with molecular techniques are becoming increasingly popular areas of study replacing the natural history emphasis which concentrated on the study of bones and leaves. Most of the popularity is generated by industry's requirements for hands on experience and research. Chemistry has become a basic tool for biological study, especially at the upper-division level.

Increased flexibility of instruction: The trend in instructional situations is for increased use of teaching assistants and support staff. In addition, more self-paced learning facilities and non-scheduled laboratories are used for study opportunities, especially for the upper-division students.

Computer impact: Computers are used extensively for statistical analysis and simulation modeling. Computers have made complex calculations and research activities possible which were not previously feasible.

Undergraduate Instruction Space Requirements

Need for larger classroom facilities: It is particularly important to commuter campuses that labs be scheduled near the time of lectures. Due to limited space, classroom lectures are often held in the laboratories. Further complicating the lecture hall space situation is the fact that very few lecture halls are available for 200 to 400 people In addition, many of these rooms do not have public address systems and are awkwardly designed for lecturing to students.

Significant increases in mandatory safety and security requirements: Increases in safety and security requirements have resulted in additional supervision requirements. Due to safety and security requirements, equipment is kept in separate rooms so the instructor must take students in small groups into the rooms for demonstrations, leaving remaining students unsupervised. In addition, currently known carcinogens and bacteria are often used in experiments which require special handling, increased supervision, and special storage requirements.

Field course space: Space is needed for field course students to evaluate the information collected in the field.

Graduate Instruction

Mix of classes: The trends affecting graduate instruction in the natural sciences are essentially the same as those affecting undergraduates. An important item brought up by the discussion group was that few graduate students take strictly graduate courses and consequently are not generating space for graduate programs.

Degree requirements vary significantly: Although the existing standard for an FTE is 15 hours, most campuses consider a student full time if they have eight hours of credit. Since less than 15 hours of credit generates less than a full-time student's space allotment, most campuses supplement graduate laboratory space with space generated by undergraduate students.

Support Space

Increased need for support space: Many examples of the need for support space were identified by the discussion group. These included space to store specialized equipment including laser disks and computers, materials which require specific safety handling, ice machines, warm rooms to grow cultures, freezers and cold rooms for storage, rooms to develop x-ray film, and dedicated labs for lengthy biological processes.

Twenty-four hour access to experiments is required due to the fact that biological experiments must be observed when a process develops and cannot be plugged into a fixed class time schedule.

Stock rooms have often been computerized to handle the increased volume of required supplies, but no space is allocated for staff in the stock rooms.

Limited graduate teaching assistant funds: Those institutions which had additional faculty dollars were able to use the funds for graduate teaching assistants. Faculty felt these positions were important teaching tools due to their ability to relate with students. However, no space is generated by teaching assistants in the CSU standards.

Research Programs

Emphasis on research: The discussion group felt that pressures were now being imposed for faculty research and publishing. They felt this was due to the need for the institution to receive national recognition, to attract faculty and for faculty to keep current in their fields of study.

The need for research space was felt to be a very high priority. Existing faculty labs are frequently utilized by students. Faculty felt that research involvement by undergraduate students is a very important part of their education. Research teams are composed of one faculty member, one graduate student, and one undergraduate student. A research lab size of 300 square feet is felt to be adequate for this team.

The group also made the point that research funds generated from non-State sources are paying for a significant amount of new equipment for which there is no space, since capital funds are not available.

Academic Offices

Increased use of computers: The discussion group noted the increased use of the personal computer and the difficulty in housing computers within the existing standards.

Integration of faculty office, work space, support, and research: Wherever possible, faculty office space in the biological sciences has been merged with support and research space. Faculty felt that this combination was compatible with increased productivity and exposure to students. The main concern with this revised working arrangement was that the allotment for the total working space does not equal the sum of the individual spaces previously occupied.

Summary

- A significant shift from natural history to biology has occurred. In particular, this is due to industry demand.
- There is a growing trend for greater hands-on experience in the biological sciences which accelerates the need for laboratory space, both scheduled and unscheduled.
- An increase has occurred in combining lecture and lab instruction in laboratory space.
- Emphasis on research is increasing and is accepted by faculty.
- Research space may be the most critical need in this discipline with the associated requirements for dedicated labs.
- Significant increases in safety requirements, including more work with hazardous materials as well as storage and disposal requirements, have increased the need for laboratory and support space.

THE PERFORMING ARTS

The performing arts disciplines consist of fine arts, music, dance, theater arts, visual arts, and design. The existing facility planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Lower Division		
Classroom	43	15
Class Lab	257	60
Upper Division and Graduate		
Classroom	43	15
Class Lab	455	80
Office Space		
FTE faculty		110/FTE
Administrative allowance		25/faculty FTE
Support Space	Allowance of 10% of total of above categories	

Factors Affecting Undergraduate Instruction

Change in structure of performing arts disciplines: In the 1950s, students in performing arts fields tended to be directed towards teaching careers. Now the emphasis is on becoming dancers, technicians, and performers. Both theater arts and dance are new subject areas since the 1950s. Dance was originally included in departments of physical education. The dance discipline requires space for dance floors and the theater arts discipline requires extensive ancillary space.

Emphasis on laboratory experience: Performing arts students spend more time in lab/studio work than they did in the past. Upper-division courses tend to be even more lab-intensive than lower-division courses. For the dance discipline, daily technique classes are required. In order to receive accreditation in dance, there must be 100 ASF per dancer in the lab.

Increased unscheduled facility needs: For music, much more time is spent in the lab or studio today than in the past. Music requires practice space ranging from smaller rooms for individual lessons to large band rooms for ensembles. These practice sessions do not produce credit and do not generate space. Industrial arts requires six hours per week of unscheduled lab for a three-credit course. Theater arts classes need more space for rehearsals and performances, especially for the upper-division classes.

Increased use of computer and media support: Computers are used for both theater arts and dance to prepare the choreography and stage directions before class. It is necessary to have a computer in the studio for use during performances. Computers are also used in graphic design. Production courses require media support in the classroom.

Undergraduate Instruction Space Requirements

Increased need for project space: Student projects tend to be larger in size than in the past. This change is reflective of the nature of the industry today. For theater arts, more storage space is necessary to house the large variety of elaborate props and equipment used today. In the past, fewer props were used and they were of a more simple design. There is also a need for space in which to display and view student projects.

Classroom standard affects course offerings: A point brought up in the discussion session was that the availability of adequate classroom facilities will determine course offerings. Design has a low unit load because space is not available for large introductory classes.

Graduate Instruction

Facilities determine graduate course offerings: The focus group participants felt that if more space were available that was suitable for graduate studies, more graduate courses would be offered. Higher priority is given to undergraduate students because of the greater volume of students and the effect on classroom capacity ratings. Graduate students in design are restricted to those who can work independently due to the lack of facilities. The group felt that 105 ASF of research space per graduate student would be ideal.

Support Space

Increased need for auxiliary space: The performing arts disciplines rely heavily on auxiliary space for equipment and support personnel. The increased safety requirements regarding the use and storage of equipment and material create a need for more storage space and higher levels of security. In addition, more expensive equipment is used today (such as video equipment), so the need for proper security and storage is essential. The space needs for teaching assistants and support staff have grown as the performing arts have expanded. The discussion group participants felt that there is a need for an

ASF allocation for technical support personnel. The necessary support staff related to the various subject areas of performing arts include TV, light and sound engineers, costumers, maintenance and construction staff, technicians, video and editing staff, dance accompanist, physical therapist (dance), and locker room personnel.

Research Programs/Academic Offices

Increased need for creative space: The discussion group noted a definite need for more creative space in the offices. Student projects are often temporarily housed in the faculty offices; when there is not sufficient space, student and faculty projects must be stored in rented space off campus. Studios in the offices would encourage faculty to conduct their creative work at school. For music, it was suggested that 180 ASF would be ideal for a teaching/research office.

High level of part-time faculty: There is a need for a high proportion of part-time faculty in specialized fields. However, recruitment is difficult because there is no work space available for these individuals.

Summary

- There has been an increased emphasis on practice/laboratory experience, especially in upper-division classes in the performing arts.
- Unscheduled facility needs are an area of particular concern to the performing arts disciplines. The facilities currently needed include space for practices and performances.
- Computer and media support are playing an increasingly important role in the performing arts disciplines.
- The participants of the discussion group felt that the availability of facilities will play a role in the determination of course offerings.
- Support space may be the most critical need of the performing arts disciplines. Facilities are needed to house support staff, equipment, and student projects.
- A creative space allowance in the faculty office standards was felt to be a high priority.

PHYSICAL EDUCATION

The physical education (PE) discipline encompasses activity based PE, recreation, health education, kinesiology, and exercise physiology. A large portion of PE space, (indoor and outdoor activity space) is governed by standards outside the scope of this project. Therefore, the comments of the discussion group relate to space needs both in and outside of the standards covered by this study.

Factors Affecting Undergraduate Instruction

Changes within the discipline: The physical education discipline has seen significant changes in recent years. Most students who major in PE are multiple track majors. The current trend in the PE discipline is an emphasis on wellness, fitness, and aging. Whereas in the past approximately 75 percent of the students who majored in PE became teachers, now only about 40 percent will become teachers. The rest of the PE majors will go into other careers such as physical therapy, etc.

Emphasis on laboratory experience: Laboratory activity is a crucial element of the PE discipline. There is a substantial amount of new technology and equipment and the emphasis is on increased lab experience.

Increased use of computer/media support: Modern PE laboratory equipment has built-in computers to record data. Films are used extensively in PE for students to view techniques and procedure for various activities. The discussion group participants expressed the need for viewing booths where two or three students can watch the tapes together.

Continuation of service function: In addition to the increased scientific emphasis in many areas of the discipline, there is a continuing need to provide activity-based courses for the student body as a whole.

Undergraduate Instruction Space Requirements

Need for larger classroom facilities: The consensus of the discussion group was that the classrooms need to be larger in order to provide a large group teaching space and to allow for unobstructed viewing. Ideally, the classrooms should be close to the location where the activities take place. PE major courses have a class-size limit of 40 students per class. There is a pressure to accept more students, so some classes consist of 50 students.

Needs for lab space vary: Physical education labs are so different, depending on the type of lab, that it is difficult to generalize about space needs. The consensus of the group was that the labs need to be specialized by type of lab since PE labs have limited interchangeability. Three main groups of PE labs are activity labs (groups or teams), specialized labs (equipment used in the instructional process), and teacher education labs (use of video equipment and one-way mirrors for filming). Each lab has its own specific equipment and space needs. Examples of PE equipment used includes oscilloscopes, treadmills, exercise bikes, pulmonary function stations, underwater weighing tank, gas analyzers, and electrocardiographs.

Support Space

Increased need for auxiliary space: Facilities are needed to store equipment, files on human subjects, films, etc. In addition, restroom and shower space is needed.

Research Programs

Increased pressure to research: The consensus was that there is an increased pressure in the CSU system to conduct research. Because more faculty are conducting research, there is a need for larger class sizes and for more self-instruction and computer labs. The current trend is toward more collaborative research. Space is also needed for the technicians who maintain the equipment and parts. Due to the limited research facilities, instructional labs are often used for research purposes.

Academic Offices

Faculty offices: The faculty feel that the current office space allotted to them is inadequate. Computers are used extensively in the offices for recording exam grades, preparing tests, course outlines, and programs. Many of the faculty members stated that they also complete office work in their homes.

Summary

- The scope of the PE discipline is broadening as new technology and equipment become available. The PE major is no longer predominantly geared toward a career in teaching. The service aspects of PE have continued, however.
- The laboratory experience is a crucial element of the PE curriculum.
- Computer and media equipment are being used extensively in the PE discipline.
- Classroom facilities need to be larger in order to accommodate larger section sizes.
- Space needs for PE labs vary depending on the type of lab and the type of equipment used in the lab.
- More support space is needed to store lab equipment and files. Other support facilities such as restrooms and showers are also needed.
- There is a pressure on faculty in the CSU system to conduct research. More space is needed for research facilities so that the instructional labs do not have to be used for this purpose.
- Current faculty office space allowances are not adequate to meet the needs of the faculty.

THE PHYSICAL SCIENCES

The physical sciences include chemistry, biochemistry, physical chemistry, geology, physics, geophysics, nuclear physics, meteorology, and molecular physics. Existing facility planning standards are:

	ASF per 100 Weekly Student Contact Hours	ASF/ Station
Lower Division		
Classroom	43	15
Class Lab	257	60
Upper Division and Graduate		
Classroom	43	15
Class Lab	398	70
Office Space		
FTE faculty		110/FTE
Administrative allowance		35/faculty FTE
Support Space	Allowance of 10% of total of above categories	

Factors Affecting Undergraduate Instruction

Increased flexibility of instruction: The trend in instructional situations is for more self-paced learning facilities and non-scheduled laboratories which are available for study opportunities, especially in the upper division. Lab courses have assumed computer literacy responsibilities because students do not have time to take separate computer classes.

Laboratory size differences: Although the simpler experiments at the lower-division level can be done in one laboratory and then disassembled, the more complex work at the upper division often requires the use of multiple labs with special equipment. This proportional difference in space requirements is not reflected in the standards. In addition, the upper-division experiments are of longer duration, increasing the need for dedicated space.

Increased use of visual aids/media support: Fine, high resolution screens are necessary in the physical sciences to view examples under study. Compact disk technology, in conjunction with computers, is likely to provide the necessary visual examples both in the classroom (through monitors) and in resource centers in the near future.

Impact of the computer: Computers have increased the ability to obtain real time data. This ability has changed the extent and accuracy of available data making it possible for students to participate in more detailed and comprehensive experiments. The close proximity of computers for some experiments is necessary in order to be able to capitalize on their use to gain efficiencies in teaching and learning.

The discussion group participants felt that off-hour access to large scale computers, probably from a centralized system, is essential to the education process.

Mission interpretations affecting classroom space needs: The traditional CSU mission, as detailed by discussion group participants, is to be sensitive to the needs of the student. This has been translated into smaller class sizes and the existence of only a few large rooms for lectures. Recent interpretations, including tenure policy, stress research work by faculty. This produces a pressure for large classes since release time, which can be used for research, is gained primarily by teaching large classes. Ability to teach more students in larger rooms is coveted by faculty because release time is generated and can be used for research.

Lectures conducted in the laboratories: As noted above, there are very few large lecture halls, so lectures are often held in the laboratories. Further complicating the problem is the fact that many of the large lecture rooms do not have public address systems and are not well designed.

Undergraduate Instruction Space Requirements

Increased laboratory equipment available: New technological developments, coupled with a decrease in equipment prices, has resulted in an increase in equipment availability. However, existing space is not sufficient to appropriately house the new computers and lab equipment. Increased computer and other advanced equipment use will require increased space and support capabilities for equipment maintenance, storage, and training.

Significant increases in mandatory safety and security requirements: The increases in safety and security requirements has resulted in increased supervision requirements. In addition, currently known carcinogens and bacteria used in experiments require special handling, increased supervision, and special storage requirements.

Safety and security requirements have resulted in increased waste storage requirements due to the need to separate waste. A minimum room size of ten feet by eight feet was felt to be needed for this purpose.

In 1962, individual fume hoods were non-existent; now they are often required.

Graduate Instruction

Mix of classes: The graduate program in the physical sciences is primarily experimental. Most of the credits are earned in research laboratories and elective classes.

Seminar requirements: Graduate instruction, along with an increasing requirement for senior theses, requires seminar room space for group discussions.

Support Space

Increased need for support space: Many examples of the need for support space were identified by the discussion group. These included space to store specialized equipment and materials which require specific safe handling. In addition, stock room systems have often been computerized to handle the increased volume of required supplies, but no space has been allocated to the stock rooms.

Physics laboratories contain volatile chemicals such as flammables and oxidants which need to be kept separated and stored appropriately.

Meteorology study requires a telescope which is usually at a remote location. Dorm space is often located at remote sites for periodic night observations, but support space on campus is also necessary to bridge the gap between campus and remote study.

Research Programs

Increased emphasis on research: The need for research space was felt to be a very high priority. Existing faculty labs are frequently utilized by graduate students. Faculty felt that research involvement by undergraduate students is becoming a very important part of a student's education. On the average, research teams consist of one faculty member, three graduate students, and three undergraduates. Undergraduates are encouraged to participate in the research program, yet no space is currently allowed.

Faculty felt that if they did not participate in research activities, their knowledge, (and thus their teaching ability), would be outdated within five years. They felt this is true of all high technology fields. In addition, discussion group members felt that research involvement helped maintain their enthusiasm for their fields of instruction. Lastly, participants noted that the majority of the new equipment in their departments was funded through non-State research grants and was available to students, thus indicating the important role played by research in the instructional program.

Academic Offices

Integration of faculty office work space, support and research: Discussion group members felt that if the office space allowance was merged with a reasonable allowance for faculty research, an adequate amount of space could be provided. It was the general feeling of the group that current allowances were not adequate. In addition, space for visiting faculty was felt to be a high priority need for the enrichment of the university's program.

Summary

- There has been a significant increase in research requirements due to the continued dynamic changes in the physical sciences.
- The computer has greatly changed the level of sophistication and learning possibilities in the physical sciences.
- Individual fume-hood requirements and the need for storage space have increased significantly due to safety regulations.
- New technological advances and lower unit costs have increased the availability of high tech equipment, increasing the need for, laboratory space and support.
- There is a need for larger, well designed lecture halls for many physical science courses.

The University of California

AGRICULTURAL SCIENCES AND PLANT BIOLOGY

Programs that are included in the category of agricultural sciences and plant biology are concentrated on the Berkeley, Davis, and Riverside campuses. They include programs such as animal science; agricultural biological science; plant science and plant pathology; food, nutrition and consumer science; textiles; forestry; conservation and resource management; soils and environmental science; entomology; and pest and disease management. Existing facility planning standards for agriculture are:

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	11.2	(44%)	15
	Class Lab	13.2	(56%)	60
	Total	24.4		
Upper Division:	Classroom	11.6	(49%)	15
	Class Lab	11.9	(51%)	60
	Total	23.5		
Graduate:	Classroom	2.6	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			140/FTE
	Graduate student			15/headcount
	Administrative allowance			60/academic FTE
Research Space:	Academic FTE			300/FTE
	Graduate student			185/headcount
Support Space:	Allowance of 10% of total of above categories			

Factors Affecting Undergraduate Instruction:

Changes within the disciplines: Course offerings have expanded significantly. Undergraduate majors are now offered in over 50 areas. In the undergraduate curriculum, an increased emphasis on programs in environmental science, conservation, and resource management has emerged. The widespread number of programs can create diseconomy of scale problems. For example, undergraduate programs in animal science need several types of teaching labs -- such as animal labs (e.g., cattle), wet chemistry labs, and computer labs -- regardless of the number of majors in the program or the enrollment in each course.

Lab exercises often are too extensive to complete during the scheduled class lab period. This is particularly true for upper-division and graduate-level labs. Lower-division laboratory work has also shifted from demonstration to experimentation. Many classes which relied heavily on field work now also use labs extensively. This results in a greater use of teaching labs on both a scheduled and non-scheduled basis.

Increased use of sophisticated equipment and computers: Teaching methods have changed with the availability of more sophisticated equipment and the use of computer modeling. There is constant "technology trickle down" from research programs into teaching labs. Self-paced learning labs are used extensively. Both laboratory sections and lectures utilize more VCRs, computers, multiple screens and other media set-ups.

Undergraduate Instruction Space Requirements

Need for more space in labs: Support space required for teaching labs, particularly at the upper division, has increased due to the size and volume of equipment used. Examples of this equipment include spectrophotometers, centrifuges, scintillation counters, incubators, plant growth chambers, freezers and refrigerators. To maximize the use of space in the core teaching lab, additional space is required outside the lab for set-up, storage, and lockers for students. Portions of undergraduate labs sometimes must be integrated with research activities. Labs also need space for related media equipment.

Graduate Instruction

Discipline tendencies: At Berkeley and Davis, degrees are offered by graduate programs rather than by individual departments. These programs often are interdisciplinary in nature. There are some terminal M.A. programs in agriculture fields at each of the three campuses.

It was estimated that Graduate I students (two years of study) spend about six to eight hours per week in the classroom and there also are a wide variety of scheduled laboratory courses for graduate students. Space requirements for these labs vary considerably and must be calculated on a course-by-course basis. It is estimated that more than half of the instruction provided to Grad I students takes place in "unscheduled" facilities. There is more faculty direction and involvement with graduate students, who may rotate among faculty research laboratories to receive instruction. Research groups may also present their own seminar series.

Grad II students have a pattern similar to graduate students in other science programs, spending about three hours a week in seminar/lecture activities and the balance of their time in research laboratories.

Postdoctoral training: The increase in postdoctoral training is due to the increased complexity of research in biology and agriculture, in which a complex systems approach is used. Postdoctoral training can last from four to five years and the trend toward an increase in postdoctoral training is expected to continue.

Support Space

Increased need for support space: With the increase in types of equipment and complexity of experiments, more support space is necessary. Focus group participants felt 35 percent of allocated lab space is necessary for support.

Research Programs

Shift in approach: A "new kind of theory" has evolved with modeling based on computer support. Model building drives more experimental approaches in order to verify the theory. There is more processing or primary data.

Inadequate research space: Multiple field observations are recorded and multiple samples are now being collected and looked at in many different ways, all of which requires more space. Special storage needs have grown. For example, programs in post-harvest physiology require a headhouse and special storage freezers. Special storage facilities are also required for isotopes and toxics.

A research team is composed of six to ten people. New faculty are encouraged to develop large teams.

Previously, between 15 and 20 percent of bench space was devoted to equipment used on a continuous basis. That proportion is now about 50 percent of bench space.

Even though computer systems are smaller than in the past and have more power, older, bulky equipment is still maintained and used.

Environmental regulations: There are new environmental regulations that affect storage of organics, toxics, and instruments. Storage room space has been lost to radioactive materials that are being held for disposal.

Academic Offices

An office size of 120 square feet does not allow room to spread out work or to house computer equipment. The increasing number of emeriti faculty will cause additional space problems.

Summary

- There has been a shift from theory, demonstration, and field work to the emphasis on laboratory experimentation and computer modeling.
- Teaching labs require more sophisticated equipment due in part to the "technology trickle down" from research programs.
- Graduate degrees are now offered by program rather than individual departments and are frequently interdisciplinary. Lab space needs vary dramatically and most lab instruction is unscheduled.
- Research is now involving multiple field observations and sampling using a variety of equipment for analysis. Special storage space and bench space for new equipment is needed.
- Increased support space needs have been identified due to more equipment and experiments which view harvest to harvest, instead of only part of the cycles.

ARCHITECTURE, URBAN PLANNING AND ENVIRONMENTAL DESIGN

These subject areas include architecture, landscape architecture, environmental design, urban planning and social ecology. Existing facility planning standards are:

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	10.3	(37%)	15
	Class Lab	17.3	(63%)	65
	Total	27.6	(100%)	
Upper Division:	Classroom	9.9	(37%)	15
	Class Lab	16.8	(63%)	65
	Total	26.7	(100%)	
Graduate:	Classroom	8.4	(100%)	15
	No scheduled class lab			
Office Space:	Academic FTE (Faculty + TAs)			140/FTE
	Graduate student			10/headcount
	Administrative allowance			30/academic FTE
Research Space:	Academic FTE			100/FTE
	Graduate student			130/headcount
Support Space:	Allowance of 10% of total of above categories			

Factors Affecting Undergraduate Instruction

Changes in program length: Only the Berkeley campus offers an undergraduate degree in architecture, although the San Diego campus will be initiating an undergraduate architecture program in the next few years. There was discussion that a four-year architectural degree may not meet industry standards in the future and that five-year programs are becoming the national standard. Increased length of undergraduate programs holds true for other programs included in this discipline group.

Increased role of the computer: Computers play a large role in the disciplines in this category although the emphasis varies. In architecture and design programs, work stations include a drafting table, a sideboard with a computer, and critique space. Landscape and environmental design programs use CAD/CAM techniques, specialized graphic simulation, and geographic and geological information systems. Urban planning students also need access to geographic and demographic data and experience in data base manipulation. The goal for all programs is to provide individual computer work stations for planning and research as well as for design.

Increase in unscheduled labs: Assigned individual studio space is a part of the "culture" in architecture and design programs at the upper-division and graduate level and there is a substantial expectation for independent design work outside of scheduled studio courses. In addition, the nature of "work in progress" requires the assignment of class laboratory work stations for blocks of time outside of scheduled course hours. Space restrictions have limited the provision of space to individual students for these purposes.

Undergraduate Space Requirements

Emphasis on the laboratory/studio: Existing space standards reflect a heavy emphasis on class labs in the curriculum and the comments of discussion group members indicated that this focus continues to exist. More than half of scheduled student time in architecture and design programs is spent in studio or lab courses. Additional studio courses would be provided if space was available.

Teaching laboratory space: The 65 ASF per station at the lower-division level was supported by group member comments. However, configuration of upper-division work stations, including the need for increased computer capability, suggested a standard of between 85 and 90 ASF for upper-division laboratory stations. Teaching laboratories include design studios, computer workstations, engineering workstations, environmental simulation labs, and other project rooms.

Classroom space: A need for classroom media support and room darkening capability was emphasized. Videos and slides are used extensively and emerging technology will involve the use of digital media. No concerns were raised with the classroom station size assumptions in the existing standards.

Graduate Instruction

Scheduled labs/dedicated studio space: The existing standards do not include specific teaching lab allowances for graduate students. However, these professional graduate programs in design include scheduled studio courses equal to about one-half of the student's scheduled work. In addition, dedicated studio space for each graduate student is felt to be essential because of the requirement for independent design work. However, in the planning area, it was noted that shared laboratory and work space is adequate.

Need for seminar space: Several discussion group members indicated a need for seminar and/or presentation space adjacent to studio areas for group conferences and presentation and critique of graduate project work.

Support Space

Space needs: Adequacy of support space was cited as a common problem. Support space needs include shops, storage of projects, gallery space, judging space and space for support personnel such as clerical staff, lab technicians and field placement personnel.

Research Programs

Variability within the category: The types of research vary widely among the disciplines. Faculty in architecture and design programs tend to be sole practitioners operating in a studio, similar to faculty in the visual arts, while planning faculty may undertake project research in a manner similar to social sciences. A common theme is the applied nature of the research and its relationship to current problems. Research is done on both an individual and team basis with a close relationship to the local areas. "Private practice" offices are the focal point for many architects, while group faculty practices are growing in areas such as urban design. Faculty conduct the bulk of their research/creative activity off campus. It was noted that providing on-campus space would improve access to faculty by graduate students and dialogue with other faculty.

Academic Offices

Space needs related to equipment: Offices for faculty in this discipline category need to include areas for drafting or laying out large papers, work with the computer and models, as well as more routine office functions. Space for these purposes (perhaps derived by combining the office and research allowances) was felt to be important for all full-time faculty.

High proportion of part-time faculty: The group reported that from one-half to 85 percent of the faculty are full time. The space generated by standard for the part-time faculty is insufficient to provide permanent space for these positions.

Administration allowance: It was felt that the allowance of 30 ASF per academic FTE was not sufficient to house today's staff and equipment and provide adequate space for storage of collections and models.

Summary

- The use of computers has increased significantly in architecture, design, planning and related disciplines. The use of computers will continue to increase, particularly for upper-division courses, graduate work, and faculty research.
- There are greater expectations today that students will spend more time in unscheduled labs. Students need to be assigned space for blocks of time in order to complete their projects, but the lack of space prevents this from occurring.
- The curriculum will continue to emphasize more lab experience for design disciplines. The group members felt that 65 ASF per station was adequate for lower-division labs, but that upper-division work stations needed to be 85-90 ASF.
- Classrooms need to have space for setting up the necessary media equipment used for instruction.
- Graduate students need to have dedicated space for independent design or project work, as well as for scheduled studio/lab courses. The group members also felt that there needed to be seminar/presentation space adjacent to studios.
- Support space is needed for storage, shops, galleries, and support staff members. Thirty ASF per academic FTE was not felt to be adequate for support space in the office category.
- Research/creative activity in these disciplines is carried out on both an independent and a team basis. Faculty currently conduct the majority of their research off campus, so they are not as accessible to students.
- Faculty offices need to have space for computers and for work tables to lay out large papers and projects. The space generated by the standards for part-time faculty is insufficient.

BIOLOGICAL SCIENCES

The biological sciences encompass a wide range of the life sciences such as biology, anatomy, zoology, microbiology, immunology and molecular biology. Related programs such as biochemistry and bioengineering also were discussed. Existing facility planning standards for the biological sciences are:

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	10.5	(43%)	15
	Class Lab	14.0	(57%)	55
	Total	24.5	(100%)	
Upper Division:	Classroom	11.5	(49%)	15
	Class Lab	12.1	(51%)	60
	Total	23.6	(100%)	
Graduate:	Classroom	2.8	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			130/FTE
	Graduate student			15/headcount
	Administrative allowance			50/academic FTE
Research Space:	Academic FTE			250/FTE
	Graduate student			145/headcount
Support Space:	Allowance of 10% of total of above categories			

Factors Affecting Undergraduate Instruction

Shift in lab experience from lower to upper division: Recent years have seen a decrease in laboratory courses at the lower division and an increase in upper-division lab work. The reasons for the reduction at the lower division include space limitations, requirements for chemistry and physics courses as a prerequisite for upper-division biology work, and an increased sophistication of the subject matter. At the upper division, there is a three-to-one relationship of lab to lecture course work. The formula factors in the existing standards appear to overstate lab contact hours at the lower-division level. In view of the high contact-hour to credit-hour ratios (two-to-one in lecture/discussion and three-to-one in laboratory) indicated by the group, the overall ratios of credit to contact hours assumed in the formula also should be reviewed.

Increased use of teaching assistants: There has been an increase in the use of teaching assistants at some campuses in discussion and laboratory sections. One campus indicated that about 30 percent of these positions are not budgeted from State funds

Increase in expectations for self study: Biology teaching labs are used for student projects approximately as many hours a day as they are used for scheduled courses. In addition, students are expected to spend several hours per week in self-paced computer labs.

Undergraduate Instruction Space Requirements

Increase in instrumentation: There has been a phenomenal increase in the availability of sophisticated equipment for use in undergraduate courses. While it is true that equipment has become automated and miniaturized, there is more equipment used in teaching labs than in the past which affects overall space needs. These changes in equipment also increase the amount of set-up time required for scheduled classes. Courses using the most sophisticated equipment and techniques can require dedicated lab space for the quarter in which the course is offered.

New health and safety requirements: In recent years there have been increased requirements in such areas as chemical fume hoods, nuclear safety, tissue disposal, and air exchange. These requirements have increased the space need per station in teaching laboratories. While not finding any problems with the existing station allowances for classrooms and lower-division labs, the group felt that a 10 to 20 ASF increase in upper-division lab station size was needed to respond to these changes.

Graduate Instruction

Need for scheduled teaching labs: Although the bulk of graduate students' work involves research leading to the Ph.D., there is a growing need for scheduled "research methods" lab courses at the graduate level, such as in recombinant DNA techniques or electron microscopy. The group felt that this need should be recognized in the standards.

Support Space

Increase need for support space: Considerable concern was expressed about support space needs. The consensus called for a 25 rather than a 10 percent ratio to meet the needs for preparation for field work, shop space for repair of precision equipment and storage of chemicals, etc.

Research Programs

The emergence of the postdoctoral fellow: One of the most significant changes in the biological sciences since the research space standards were developed in the 1950s has been the growth in the number of postdoctoral fellows. These positions, funded primarily by non-State funded grants and contracts from non-State sources, make up 20 to 50 percent of lab personnel. Postdoctoral experience is now virtually mandatory for an academic or research career in the sciences. Recognition of space allowances associated with these non-State funded positions was cited as a high priority need.

The research team: Looking at the amount of space needed to accommodate a research team offers a potential approach for establishing standards. Models have been developed by the Berkeley campus based on average team size of seven to eight including one faculty member, graduate students, postdoctoral fellows, plus up to two undergraduates and possibly visiting faculty. The Berkeley model includes a lab of 1,480 ASF for teams in biochemistry and microbiology where equipment needs were great. A lab of 1,200 ASF was felt to be sufficient where less instrumentation is used and 900 ASF is appropriate for field-oriented research. Other campuses have developed similar models for construction of new labs. Some specialized equipment needs to be provided in these core laboratories, such as equipment for microscopy, ultracentrifuges, scintillation counters to monitor radioactivity, and ultra freezers. Other equipment can be shared in space separate from core laboratories, such as tissue culture labs and radioisotope facilities, and space in addition to core laboratory areas cited above needs to be provided for this purpose.

Academic Offices

Increased allowances not a high priority: Faculty participating in this discussion group indicated that the current office space allowance (130 ASF) was sufficient, including the need to house a computer station. Priority was accorded to providing adequate lab space, space to interact with students, and some office space for postdoctoral fellows. Support space for offices was indicated as an area where improvements could be made.

Summary

- There has been a shift in laboratory instruction from the lower to the upper division.
- There is a growing expectation for self-paced study in addition to scheduled courses.
- Growth in the availability of specialized equipment for undergraduate instruction and in research programs has affected space needs in laboratories and has increased the need for shops and storage space.
- New health and safety standards have increased laboratory space needs.
- Postdoctoral fellows play a major role in research. Recognition of space needs for these personnel was cited as a high priority.
- The research team approach used in the sciences offers a potential basis for establishing new research lab standards.

CHEMISTRY, BIOCHEMISTRY, AND CHEMICAL ENGINEERING

The participants in this discussion session represented programs in biochemistry, chemistry, applied mechanics and engineering science, and chemical and nuclear engineering. Existing facility planning standards for chemistry (as a part of physical science) and chemical engineering are outlined at the right.

Factors Affecting Undergraduate Instruction

Increased diversity in coursework and specialized equipment: Undergraduate programs in chemistry and chemical engineering have become more diverse in response to industry needs, resulting in the need for more specialized instructional equipment and teaching laboratories. Students require more access to teaching labs on an unscheduled basis in order to complete assignments. A greater array of support staff is required for the operation of teaching labs on a scheduled and unscheduled basis. Because of the broad range of experiments required in chemical engineering, there is a trend to develop bench-scale experimentation and modeling to provide the variety of experiences required in the curriculum. There has also been a trend to develop more elective courses at the upper-division level.

CHEMISTRY

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	12.6	(55%)	15
	Class Lab	10.4	(45%)	60
	Total	23.0		
Upper Division:	Classroom	12.8	(56%)	15
	Class Lab	9.9	(44%)	70
	Total	22.7		
Graduate:	Classroom	2.6	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			120/FTE
	Graduate student			15/headcount
	Administrative allowance			50/academic FTE
Research Space:	Academic FTE			250/FTE
	Graduate student			145/headcount
Support Space:	Allowance of 10% of total of above categories			

CHEMICAL ENGINEERING

(Standards based on ½ engineering and ½ physical science standards)

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	10.7	(43%)	15
	Class Lab	14.3	(57%)	75
	Total	25.0	(100%)	
Upper Division:	Classroom	12.4	(61%)	15
	Class Lab	8.0	(39%)	90
	Total	20.4	(100%)	
Graduate:	Classroom	3.2	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			140/FTE
	Graduate student			15/headcount
	Administrative allowance			55/academic FTE
Research Space:	Academic FTE			275/FTE
	Graduate student			165/headcount
Support Space:	Allowance of 12.5% of total of above categories			

Increased use of computers and media equipment: Computers and media support are used extensively in these programs. Students typically need computer access for four to eight hours a week for processing experimental results, doing computational assignments, and for word processing. Because of heavy student use of open access labs, full-time staffing of computer labs is required.

Undergraduate Instruction Space Requirements

Space requirements for classrooms: Classrooms need adequate space for audio/visual equipment used during lectures. There is also a need to have preparation space associated with classrooms for set-up of lecture demonstrations.

More equipment used in the laboratories: Much of the equipment used today in undergraduate programs either did not exist in the 1950s or was used only for the most sophisticated research. The use of gas chromatographs, infrared spectrophotometers, and lasers is common in undergraduate courses. Lasers and x-ray equipment must be housed in rooms separate from the main teaching lab and this is also true for many types of measuring instruments which need to be separated from preparation materials.

Computers are used regularly in the labs for recording collected data. These computers need to be in close proximity to the experiment for performing calculations but also need to be physically separated from chemicals and fumes. Some teaching labs are designed around individual work stations, such as labs for organic and inorganic chemistry, and have significant fume hood requirements. Other labs are organized around an experimental work station, focusing on a fixed experimental or equipment set-up, such as labs for physical chemistry, analytical chemistry, or instrumentation labs. This latter type of lab might have large benches for optical equipment or special set-ups for laser experiments. The increased variety of experimental set-ups per course may mean that fewer students are served per experimental station and that more dedicated labs are required, thus decreasing the utilization rate of teaching labs.

Fume hoods determine lab station size: Fume hoods are a major determinant in teaching laboratory design and size. The ratio of fume hoods to students in undergraduate labs decreases as course work becomes more sophisticated. The actual fume hood to student ratio can vary from one eight-foot hood per 12 students in some introductory freshman courses to one four-foot hood per one student in upper-division organic chemistry courses. A standard fume hood has been four feet wide but group participants felt that hood requirements in teaching labs may increase to seven to eight feet wide per station because of increasing safety regulations governing the use of chemicals and toxic substances. There has been some conversion to microscale experiments and computer modeling in order to reduce special ventilation and space requirements. Other safety requirements in labs relate to the need for secure storage of generated waste materials prior to their treatment and disposal

Increased need for dedicated labs: The increased number and diversity of lab courses has resulted in an increased number of labs dedicated to a single course. Dedicated labs are necessary due to the difficulty or impossibility of moving experimental apparatus and the incompatibility of physical space requirements between individual work station labs and experimental work station labs. For example, the requirements of biochemistry, physical chemistry and instrument analysis labs are quite different and separate labs need to be dedicated to each function, as well as to individual courses within each function. The use of multipurpose teaching labs has become more impractical. In addition, the number of students who can be accommodated per experimental set-up has decreased in some cases. Combined with the need to provide student access to labs on an unscheduled basis, these factors have led to a reduction in scheduled utilization of class labs in chemistry.

Graduate Instruction

Graduate education: In recent years, there has been a trend toward obtaining a master's degree as the minimum level "standard" for education in chemistry and particularly in chemical engineering. Group participants predicted that the master's degree would eventually eliminate the bachelor's degree as the minimum preparation required for employment in the field. Graduate programs emphasize independent research and there are few scheduled laboratory courses at the graduate level in chemistry. Terminal master's programs in chemical engineering involve more highly structured and scheduled lecture and laboratory courses.

Need for teaching assistant office/work space: Many chemistry programs require graduate students to be a teaching assistant for at least one year. TAs need a separate location from their research laboratory activity in which to consult with students. The participants felt that shared TA offices would be acceptable.

Postdoctoral students: Postdoctoral training is a prerequisite to academic employment and often to employment in the industry as well. There is usually one postdoctoral fellow per research group. In organic and inorganic chemistry programs, there is a typical ratio of one postdoctorate for every three graduate students. Chemistry programs may have two to three postdoctorates per faculty. Chemical engineering programs now have fewer postdoctorates, with one per three faculty; this ratio is expected to increase but not to the same level as chemistry programs.

Support Space

Increased need for support space: Storage space is needed for equipment and toxic waste material before it is processed or disposed of on a long-term basis. Shop facilities are very important, especially for electronics. Space is needed to house support staff. Administrative staff includes student advisors, purchasing staff, administrative management, bookkeeping staff, and stockroom staff. In addition, the group noted that there is no separate allowance for conference/seminar rooms.

Research Programs

Research space needs: Research is usually conducted in teams made up of faculty, graduate students, postdoctoral fellows, and sometimes undergraduates. Shared research space was common in the 1950s because there was little specialized equipment. In chemistry, three major types of research laboratories can be defined. Organic and inorganic labs provide individual work stations, with the amount of space driven by the number of fume hoods. For example, work stations for four researchers might require a total of six fume hoods. In addition to these workstations, space is required for a data station, chemical storage, and instrumentation, resulting in a total of 300 to 325 square feet per researcher. Analytical and physical chemistry labs require fewer fume hoods but the space required per researcher is the same because of a larger amount of fixed equipment. A third type of laboratory is needed for theoretical chemists who require substantially less space but heavy computer support. It is less easy to generalize lab types for chemical engineering research, where space needs are more dependent on the focus of study and there may be large-scale requirements such as walk-in fume hoods, reactors, and the like.

The group estimated that an additional 15 to 25 percent space allowance was needed for shared research facilities, such as nuclear magnetic resonance (NMR) facilities, x-ray crystallography, micro analytical lab, hydrogination lab, and special laser set-ups. An additional 15 percent allowance would be needed for shops (machine electronics, glass, wood), stockroom and receiving, and storage. In addition, there needs to be sufficient conference room space to allow research groups to have access to them for a period of one hour per day.

Academic Offices

Need for larger offices: The discussion group participants agreed that faculty offices need to be large enough to store literature, record-keeping material, and computers. The need for space for consultation with students, especially graduate students, was emphasized. The group felt that the minimum office size should be 140 ASF. They also felt that there needs to be a dedicated conference room for each department.

Summary

- Industry requirements have resulted in the need for special instructional equipment and teaching labs.
- The use of computers and media equipment has increased in chemistry and chemical engineering teaching programs.
- The space needs pertaining to classrooms are preparation space and audio/visual capabilities.
- Specialized lab equipment such as chromatographs and infrared spectrophotometers have increased space needs.
- Teaching lab station size must conform to the fume hood requirements. Existing, standard fume hoods are four feet wide, but the group felt that they should be seven to eight feet per station.
- Storage space must be provided for waste materials and for separation of functions in teaching labs.

- Dedicated labs, set up for a single course per term, are necessary because much of the equipment is not movable or is required for the duration of the course.
- More support space is necessary for housing equipment and support staff members.
- Graduate programs are emphasizing independent research requiring significant time in unscheduled lab work.
- Office space needs to be large enough to store the necessary material and to meet with students. The group felt that 140 ASF would be adequate.
- Teaching assistantships are required in many chemistry programs increasing the need for working space for these positions.
- In chemistry, postdoctoral training is often a prerequisite to employment. Existing standards do not provide space to house postdoctoral fellows.
- Research space now involves specialized equipment, often requiring dedicated space and technical support. This equipment is less conducive to shared space than in the past.

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

The participants in this discussion session represented the disciplines of electrical engineering, computer engineering (development of computers), and computer science (application of computers). Existing facility planning standards for engineering programs are listed below. The existing standards for computer science programs incorporate half the class lab contact hours and ASF/station requirements, as well as substantially less office and research space for faculty and graduate students.

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	8.7	(32%)	15
	Class Lab	18.1	(68%)	90
	Total	26.8		
Upper Division:	Classroom	12.0	(67%)	15
	Class Lab	6.0	(33%)	110
	Total	18.0	(100%)	
Graduate:	Classroom	3.5	(100%)	15
	No scheduled class lab standard			

Office Space:	**Academic FTE (Faculty + TAs)**	**160/FTE**
	Graduate student	**15/headcount**
	Administrative allowance	**60/academic FTE**
Research Space:	**Academic FTE**	**300/FTE**
	Graduate student	**185/headcount**
Support Space:	**Allowance of 15% of total of above categories**	

Factors Affecting Undergraduate Instruction

Changes within the disciplines: The subject areas encompassed by electrical engineering, computer engineering, and computer science have changed dramatically since the 1950s. Electrical engineering used to be considered an analytical science, but now the emphasis is on both analysis and design. Students tend to work in groups to design projects, whereas in the past, individual, analytical work was the norm. Consequently, more space is needed to design and store the projects. In addition, the diversity of electrical engineering programs has increased. A much broader scope of instruction is offered than in the past, including graphics, micro and electrical. Industry and accreditation agencies have exerted pressure on universities to increase the degree requirements for these disciplines, including a greater emphasis on laboratory experience such as senior design courses with a maximum of 15 to 20 students. More than four years are usually necessary to complete the degree requirements today. A higher degree of skill is required from the student today in order to employ the concepts of the subject matter. As a result, more lab time is required for undergraduate students.

Increased use of computers and media equipment: The use of computers and media equipment has grown rapidly during the past several years. For example, computers are now a primary resource tool. Classrooms and labs use videos, overheads, and computers with monitors. Because of these increased technical requirements, additional staff such as computer programmers are required to support the instructional program.

Increased need for unscheduled labs: Students require more access to labs on an unscheduled basis to learn how to operate the sophisticated equipment used today and to complete experiments or projects at their own pace. "Unscheduled" access is required to self-paced computer workstations, CAD/CAM design stations, and laboratories dedicated to specific courses. Unscheduled laboratory time required to complete course work is equal to or greater than scheduled laboratory course time per week.

Undergraduate Instruction Space Requirements

Classrooms: The classrooms used for electrical engineering and computer science courses need to be large enough to house the various computers and media equipment used during instruction. Lecture classes are often large, while discussion sections are smaller in class size.

Laboratories: Although the newer equipment used in the labs tends to be smaller than in the past, more pieces of complex equipment are used now and station space requirements have increased. In addition, safety requirements for certain materials or equipment mandate more space in the labs. For example, labs housing microfabrication equipment can range from 2,000 to 5,000 square feet, and labs in which toxic materials are used must have extra exits and special air ventilation equipment. Many upper-division lab courses in electrical and computer engineering require dedicated labs since the equipment is not easily set up and taken down; examples of such labs requiring dedicated space include labs for microwave, microfabrication, optical processing, and solid state devices. For example, a senior-level course in optical electronics may require a lab of 600 square feet that can be used by only three to five students at a time.

Graduate Instruction

Graduate classroom and laboratory space: The scheduled course requirements for graduate students in master's programs are substantial. Consequently, master's level students do little independent research. However, much of their coursework must be completed during "unscheduled" laboratory hours. Group participants felt that graduate teaching lab space is inadequate to meet self-paced learning needs.

Need for teaching assistant office/work space: The participants of the discussion group made the point that teaching assistants perform an important function in undergraduate instruction. Teaching assistant offices should be separate from research and study space provided for graduate students.

Support Space

Increased need for support space: Storage space is needed to house student projects and equipment. Space is also required to house the support staff personnel. Computer science programs in particular employ a large number of support personnel including programmers and technicians. Several different types of shop and support facilities are needed to support the teaching and research program, including electronics and machine shops, computer machine rooms, and various design facilities. There also needs to be more space for data storage, conference rooms, and central administration.

Research Programs

Inadequate research space: Research is usually conducted in teams, although the size of the teams varies greatly by the type of research. Undergraduate students are sometimes involved with the research activities. Research cannot easily be conducted in the undergraduate instructional labs because the equipment is less sophisticated than that required for research and is used by inexperienced students. More stringent "clean lab" facilities also are required for research than for teaching. Research labs often are shared by several teams and large-scale research projects in computer science can involve several faculty and large numbers of graduate students.

Academic Offices

Need for larger offices: Faculty offices must be large enough to house personal computer set-ups as well as larger and more sophisticated computer work stations. There must be space for bookshelves in the offices since the periodicals used for research and instruction are also kept in the offices. In addition, research teams frequently meet in faculty offices.

Summary

Programs in electrical engineering, computer engineering, and computer sciences have diversified and have changed from an analytical emphasis to a dual emphasis on analysis and design.

- Computers and media equipment have become an important element of instructional programs.
- Use of self-paced labs and regular instructional labs on an unscheduled basis is an increasingly important component of the curriculum for these disciplines.
- Classrooms need to be equipped with multimedia and computer-demonstration equipment.
- More pieces of equipment are being used in teaching labs, so that work station size needs to be larger. In addition, space standards need to recognize health and safety requirements.
- Graduate students work primarily in laboratory settings, but existing standards do not generate space for scheduled course work which predominates at the master's level. Space for teaching assistants to meet with undergraduates should be separate from research and study offices provided for graduate students.
- More support space is needed for equipment storage, support personnel, shops, data storage, and computer support.
- Office space needs to be large enough to accommodate computer workstations and for research teams to meet.

GEOGRAPHY AND ANTHROPOLOGY

The participants in this discussion session represented programs in anthropology, geography, and archeology. Existing facility planning standards are:

GEOGRAPHY (based on ½ social sciences and ½ physical sciences standards)

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	13.8	(69%)	15
	Class Lab	6.3	(31%)	45
	Total	20.1		
Upper Division:	Classroom	13.7	(72%)	15
	Class Lab	5.4	(28%)	50
	Total	19.1		
Graduate:	Classroom	8.2	(100%)	15
	No scheduled class lab standard			

ANTHROPOLOGY (based on ½ social sciences and ½ biological sciences standards)

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	12.8	(61%)	15
	Class Lab	8.1	(39%)	43
	Total	20.9		
Upper Division:	Classroom	13.1	(72%)	15
	Class Lab	6.5	(28%)	45
	Total	19.6		
Graduate:	Classroom	8.2	(100%)	15
	No scheduled class lab standard			

GEOGRAPHY AND ANTHROPOLOGY

Office Space:	Academic FTE (Faculty + TAs)	125/FTE
	Graduate student	15/headcount
	Administrative allowance	40/academic FTE
Research Space:	Academic FTE	145/FTE
	Graduate student	80/headcount
Support Space:	Allowance of 7.5% of total of above categories	

Factors Affecting Undergraduate Instruction

Changes in program emphasis: Participants indicated that in geography, program emphasis has changed dramatically since the 1950s and space needs differ greatly according to what part of the discipline a department has chosen to pursue. Program emphases may include:

- Spatial data analysis and geographic information systems, which require computer work stations and space for analysis of maps and map storage;
- Physical and biological ecosystem studies, which require sophisticated, specialized labs; and
- Human geography, which requires space for group research projects.

Traditional cartography comprised most of the field in 1955, so programs across campuses were very similar and had like space needs. Even within this area, undergraduate programs now use computers and have wet labs for soil analysis and hydrology studies.

Like geography, anthropology has become more specialized and includes sub-disciplines such as cultural anthropology, ethnography, bio-anthropology, and linguistics. The resultant shift toward more quantitative analysis has increased the need for computer labs. Students now receive instruction in field work, laboratory work, and computing.

Undergraduate Space Requirements

Emphasis on laboratory experience: The shifts in program emphasis described above have had a dramatic impact on space needs, particularly in labs In geography, student work with geographic information systems is becoming an essential part of lab experience requiring scheduled and unscheduled computer labs. Wet labs for soil analysis and hydrological experiments often house fixed equipment which precludes other uses, thus limiting utilization. This is also true for labs used to conduct geomorphology experiments to test erosion patterns using flumes.

In anthropology, most lab work in the 1950s centered around dry bone measurement and simple analysis and associated storage. This linear type of lab analysis has shifted to experimental lab work requiring x-ray, bone mineral analysis, CAT scans and electron microscopy. Wet labs are now needed to conduct muscle/bone experiments/analyses. Some dedicated labs are needed for collections that cannot be moved or for special equipment. Film, video and sound media is used extensively in ethnographic courses, requiring multi-media, darkroom and editing facilities.

Classroom space: The use of computers in geography for reference and modeling will increase the need for computer image projection capabilities in the classroom.

In anthropology, the shifting emphasis from folklorist to psychological anthropology has been accompanied by an increase in the use of film, both in the field and in the classroom to observe social patterns. As a result, the need for media support in the classroom has significantly increased.

Contact hour ratios: Participants from anthropology programs felt that in lower-division classes, more time was spent in classrooms and less in scheduled labs than currently reflected in space allowances. Specifically, they suggested that for 15 credit hours, 15 hours of classroom and five hours of scheduled lab would be more realistic, with three hours of unscheduled computer lab time as typical.

Representatives from both geography and anthropology felt that contact-hour assumptions per 15 credit hours for upper-division classes were low. In geography, they estimated 14 classroom hours and eight class lab hours with four to six unscheduled lab hours. In anthropology, participants estimated 12 classroom hours and eight class lab hours with four to six hours of unscheduled lab work.

Graduate Instruction

Use of computer labs: Analog and digital map analysis did not exist in the 1950s. Computer modeling in geography has become an important aspect of graduate instruction. As a result, there is greater need for scheduled and unscheduled computer labs. Required equipment includes work stations capable of conducting computer modeling experiments, input/output devices such as large and small graphic tablets and plotters, and tape storage cases

Increase in graduate lab use requirements: Hours spent in scheduled and unscheduled labs have increased since standards were set. In anthropology, participants estimated four contact hours per week in scheduled labs, and more than ten hours per week in unscheduled labs for graduate students. Similarly, in geography, participants estimated five contact hours per week in scheduled labs and five to ten hours in unscheduled labs.

Support Space

Participants estimated support space should be 30 to 40 percent of teaching space, rather than the current 7.5 percent allowance. In anthropology, refrigerated storage and space for much larger samples and artifacts are needed. In the 1950s, a field trip may have yielded 1,000 specimens, whereas now students may return with ten times that amount. Equipment available today can analyze more items and do a greater variety of tests than in the past, e.g., pollen examination. Also the nature of anthropological collections is that they keep building since items are not discarded; thus there is an ever-growing need for storage space, some of which must be climate-controlled, e.g., refrigerated, humidity controlled, etc.

Research Programs

In geography, there has been less shift from theory to application than in some of the other sciences. Laboratory space needs are dependent on the program emphasis.

In anthropology, most research in the 1950s was archival, using materials available. Now the trend is toward experimental research requiring more and greater variety of equipment.

Research teams were not common in anthropology in the 1950s. As in many other disciplines, there has been a shift in recent years to larger multi-disciplined research groups to bring together all the expertise required to conduct ethnographic research, e.g., cultural, medical, biological, and archeological.

Anthropology labs have changed to include more specialized analytical equipment and resulting technical support requirements. Current standards do not provide space for the shops and technicians required to support labs and equipment.

Office Space

Faculty offices need room for desk, computer, printer, book shelves, cabinets, work tables, and chairs. In both anthropology and geography, there is need for extra space to work with artifacts and specimens as well as space to view slides of field trip locations. Finally, the group noted that since office standards do not provide allowances for departmental libraries, many books and unpublished documents are stored in faculty offices.

Summary

- Program emphasis has changed in both geography and anthropology, resulting in the need for more labs.
- The nature of lab work has changed to require more specialized equipment such as flumes for hydrological experiments, x-rays for bone analysis, etc.
- The trend toward sub-disciplines requiring greater quantitative analysis such as digital map analysis and access to data base information has increased.
- Increased use of film and other media in anthropology has increased the need for media support in the classroom.
- There has been an increase in lab contact hours since the original assumptions were established in the 1950s.
- Access to labs on an unscheduled basis has also increased, based on student need to complete experiments and other lab work.
- Due to specialized equipment, the number and nature of experiments, and growing artifacts collections, storage requirements are significantly greater than the space generated by existing standards.
- Offices require more space to allow seating for several students and tables for working with slides and artifacts.

LINGUISTICS, FOREIGN LANGUAGES, COMMUNICATIONS, AND SPEECH

The participants in this discussion session represented programs in German, linguistics, communication, and speech and hearing sciences. Existing facility planning standards for foreign languages are listed below. The existing standards for humanities programs are the same, except that lower-division student contact hours in classroom work were estimated to be 18.9 hours per FTE, with no scheduled class laboratory contact hours.

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	15.0	(100%)	15
	Class Lab	0.0		
	Total	15.0	(100%)	
Upper Division:	Classroom	15.0	(100%)	15
	Class Lab	0.0		
	Total	15.0	(100%)	
Graduate 1:	Classroom	12.0	(100%)	15
	No scheduled class lab standard			
Graduate 2;	Classroom	12.0	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			130/FTE
	Graduate student			30/headcount
	Administrative allowance			30/academic FTE
Research Space:	Academic FTE			40/FTE
	Graduate student			0/headcount
Support Space:	Allowance of 5% of total of above categories			

Factors Affecting Undergraduate Instruction

Changes within the disciplines: There are more course offerings today in the subject areas of foreign languages, linguistics, communications and speech than there were when the standards were developed. Now there is a broad array of foreign language course offerings, including near eastern languages, African, Germanic, and all Asian languages. Many linguistics and communications programs are laboratory based, such as psycholinguistics, computational linguistics, and mediated communication. In addition, more courses are being taught in English as a second language; these courses do not generate credit and therefore do not generate space using existing space standards. Santa Barbara is the only campus that offers a program in speech and hearing pathology.

Increased use of media equipment and computers: Media equipment is used extensively in the language and communications disciplines. Classrooms and laboratories need to have media capabilities for videos, TVs, films, and slides. Computers are also used in these subject areas. Phonetics labs use a significant amount of computer equipment, foreign language courses use computers for word processing, and some linguistics courses have a computational component.

Increased need for unscheduled labs: There are few scheduled labs for foreign language programs. The existing standards treat traditional language labs as "non-standard" space and assume they will be used primarily on an unscheduled basis. The number of hours spent in unscheduled labs is about equal to the number of hours spent in the classroom.

Upper-division linguistics and communications courses do have laboratory components, and labs are needed on both a scheduled and unscheduled basis.

Undergraduate Instruction Space Requirements

Need for more space in labs: The focus group participants noted that work station space is most lacking in the labs for lower-division linguistics courses. Multimedia labs are needed as well as extensive traditional tape labs. These labs did not exist in 1955. Phonetics labs require specialized space for soundproof recording booths, sonargraphs, palatographs, and seismographs. A significant amount of computer equipment is also used in the labs. Computer labs, phonetics labs (teaching and research), and psycholinguistics labs (which use human subjects) need to be dedicated.

Graduate Instruction

Independent research work: The model of graduate learning for phonetics is an apprentice situation where the graduate student will link with the professor for instruction. However, for all other disciplines, graduate students undertake their research independently rather than in a team.

Graduate classroom and laboratory space: Graduate students seldom have scheduled labs, but they do spend a significant amount of time in unscheduled labs, such as computational linguistics, computer labs, or video production and editing facilities. A reading/study area is needed for reference material (e.g., grammars and dictionaries of several hundred languages), group discussions, and for class and media preparation.

Support Space

Increased need for support space: Storage space is needed for special collections (e.g., video or microfiche archives) and teaching equipment. Space is also required for support staff such as media clerks, clerical staff, computer maintenance technicians, and peer advisors. The ratio of faculty to support staff is about 4:1. Additional space needs include conference or seminar room and a gallery in which to present graduate projects.

Research Programs

Inadequate research space: The focus group participants felt that the method of calculating standards for research space are not as sound as the methods for class and lab space. Research work takes place on both a solo and team basis and is both office and laboratory-based.

Academic Offices

Need for larger offices: The discussion group participants felt that 130 ASF per faculty is adequate for office space. However, space requirements are significantly affected by the location of centralized facilities, such as departmental reference libraries and seminar space.

Need for office space for visiting faculty: Visiting faculty are important because they participate in seminars and bring new ideas to the university. The participants of the focus group felt that space equal to 10 percent of the total ASF allocated to permanent faculty should be provided for visiting faculty. It was noted that adequate office space was a factor in the successful recruitment of visiting faculty.

Summary

- The subject areas of foreign languages, linguistics, communications, and speech have grown dramatically in the number and breadth of courses that they offer.
- Computers and media equipment are used extensively in these disciplines to assist the instruction process.
- Although there are few scheduled labs for foreign language and communication courses, there is a significant use of labs on an unscheduled basis.
- The labs need more space per station and more room to house the media and other equipment used.
- Graduate students who are TAs need office space for meeting with students and for class preparation.
- More support space is necessary to house collections, equipment used in the classrooms and labs, and support staff members.
- The focus group participants felt that the method for calculating research space needed revision.

PERFORMING ARTS

The performing arts category currently includes programs in music, theater, cinema and dance. Facility planning standards and assumptions are the same for both performing and visual arts programs. Existing facility planning standards are:

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	10.3	(37%)	15
	Class Lab	17.3	(63%)	65
	Total	27.6	(100%)	
Upper Division:	Classroom	9.9	(37%)	15
	Class Lab	16.8	(63%)	65
	Total	26.7	(100%)	
Graduate:	Classroom	8.4	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			140/FTE
	Graduate student			15/headcount
	Administrative allowance			50/academic FTE
Research Space:	Academic FTE			100/FTE
	Graduate student			125/headcount
Support Space:	Allowance of 10% of total of above categories			

Factors Affecting Undergraduate Instruction

Growing emphasis on practice: There is a growing emphasis on practice in the performing arts curriculum. Prior to World War II, the primary emphasis of most university programs dealt with learning about the arts rather than performing at an optimum level. Courses dealt more with appreciation, introduction to the field, and contained less vigorous performance components. Practice-oriented programs were largely limited to conservatories or single purpose schools of theater or dance. In the 1950s, the pattern began to change and the emphasis of the recent past, particularly at the upper-division level, is on performance.

Service course component: Since performing arts are a key element of a liberal arts curriculum, there is also a substantial service course component at the lower division which primarily involves lecture and discussion sessions. The two roles played by performing arts departments make it difficult to generalize about the distribution of lecture and laboratory courses within the curriculum and facilities requirements at the lower division. This is accentuated by the lack of facilities on some campuses which limits lower-division offerings to lecture courses.

Increased use of "lab" space at the upper division: Numerous examples were given by participants of an increased use of practice facilities at the upper division. In some cases, as many as six contact hours in a "lab" or studio setting is required for one unit of credit. At most institutions, there is a clear distinction between the curricular pattern of upper division (with greater stress on performance and lab work), and the lower division. A careful review of the formula distribution of contact hours between lecture and lab appears to be appropriate in this area.

Increased expectations for unscheduled room use: A notable outcome of the discussion group was an indication of the substantial expectations placed upon students for commitment of time in unscheduled "lab" or studio work in practice or rehearsing. Dance requires more unscheduled hours per week of studio use than scheduled hours. These increased expectations and the lack of rehearsal or practice space was cited as a major problem.

Increased use of the computer: Numerous examples were provided regarding the use of the computer in the performing arts. Computer-assisted design (CAD) is used in theater for set design. Computers are used in music composition and notation and a system has been developed for dance (Laban) notation. In the latter area, use of video tape also plays a large role in improving dance performance.

Undergraduate Instruction Space Requirements

Classroom requirements: Requirements vary among the individual disciplines although there appeared to be a need for more demonstration space in classrooms than in most disciplines. In music, the need for dedicated rooms, acoustically designed and containing a grand piano, was cited. The need for video support in the other performing arts disciplines was also noted.

Teaching laboratories and related space: The wide variety of rooms which are involved in performing arts instruction was an illuminating outcome of the discussion group. In addition, the distinction between "standard" and "non-standard" space was not entirely clear (i.e., which types of rooms are covered by the standards and which are not). Performance space is non-standard but rehearsal or practice space may be defined either way. A need for listening rooms and viewing rooms was indicated. Space allowances were also a matter of concern. Listening space requires 40 to 50 square feet, dance studios approximately 120 ASF per student, and music practice rooms need to be large enough not only to accommodate the group but also to allow for the proper transmission of the sound. Dedicated studios/ practice rooms are needed for choral and orchestral use. Although not a specific space factor, dance practice requires a spring floor, reducing the ability to use other spaces for this purpose.

Graduate Instruction

Assumptions of scheduled time appear appropriate: The formula assumption of 8.4 contact hours per week of classroom use was consistent with the requirements indicated by discussion group members. No scheduled laboratory hours were noted. However, there is a significant need for use of studios, rehearsal and practice rooms on an unscheduled basis in graduate education in the performing arts which affects space requirements.

Support Space

Increased need for support space: The 10 percent formula allowance received substantial criticism. In dance and theater, there is a need for changing rooms and, in the latter area, space is necessary for storage of sets, design models, costumes, etc. Shops serve an important function in theater and music also requires extensive space for instrument storage. Space needs for sound studios, editing rooms and related technical personnel were also cited. In theater, it was estimated that support space should be about 50 percent of instructional space. In music, about 25 percent was felt to be appropriate for shops and storage. Support space is also needed for a wide range of staff personnel, such as recording technicians, production managers, instrument technicians, music librarians, and theater managers.

Research Programs

Creative activity space: The performing arts are often collaborative, particularly in theater. A space for faculty to work with students on creative projects was indicated as desirable. Merging the research and office space allowances would provide sufficient space allowances to meet most needs.

Academic Offices

Increased use of computers and equipment: The group noted the increased use of both computers and specialized AV equipment in the office. Although some felt the existing 140 ASF allowance too small, adding the research allowance appeared to meet most needs. For example, in music programs faculty ideally would have a combination office-studio that included meeting and work space as well as piano and practice areas.

Increased part-time faculty and visiting faculty: Music programs often have a high proportion of part-time faculty due to the number of instruments and skill areas for which instruction must be provided. In addition, practitioners in the arts are increasingly used to augment a core staff. Providing some space for these individuals is a problem. Space for visiting faculty, who are often very prestigious performers, is a high priority not met by existing standards.

Summary

- There is a growing emphasis on practice and in advanced skill training in the performing arts, increasing the need for studio, practice and performance space.
- There is an extremely high expectation for unscheduled use of facilities by students in order to meet course requirements.
- The proportional distribution between lecture and lab in the existing standards may overly emphasize lab hours at the lower division and lecture hours at the upper. Graduate course hour assumptions were supported by the discussion group.
- The space allowance for classrooms was criticized, and concern was also expressed that the allowances for "labs" did not meet the need for the wide variety of teaching space involved in the performing arts.
- Support space allowances were felt to be inadequate.
- The combination of research and office space allowances appeared to be sufficient to meet most faculty needs, although the need to provide space for part-time faculty and visiting performers is a problem.

PHYSICAL SCIENCES

The disciplines represented in the physical sciences discussion group included physics, earth science, astronomy, and oceanography, plus mechanical and civil engineering. Current facility planning standards for the physical sciences are:

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	12.6	(55%)	15
	Class Lab	10.4	(45%)	60
	Total	23.0	(100%)	
Upper Division:	Classroom	12.6	(56%)	15
	Class Lab	9.9	(44%)	70
	Total	22.7	(100%)	
Graduate:	Classroom	2.6	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			120/FTE
	Graduate student			15/headcount
	Administrative allowance			50/academic FTE
Research Space:	Academic FTE			250/FTE
	Graduate student			145/headcount
Support Space:	Allowance of 10% of total of above categories			

Factors Affecting Undergraduate Instruction

The computer: Probably the most significant change in undergraduate instruction in the physical sciences is the advent of the computer, both main frame and micro. Freshmen are receiving CAD instruction and computer labs are open 24 hours per day. A need for dedicated computer labs, to focus on science and engineering software, was indicated. The computer has also made new lab procedures possible and, along with more elaborate instrumentation, has served to increase the space needed to house the equipment. Other new technologies, including the laser and remote imagery, have revolutionized teaching and research in these fields.

Increase in laboratory and discussion sections: Both the sciences and engineering disciplines reported an increase in laboratory requirements at both the lower and upper division. In addition, discussion sections have been added to most physics courses, involving a greater number of teaching assistants than in the past. Overall, the pattern is one of large lectures, more discussion sections, greater scheduled time in the laboratory, and the expectation of unscheduled laboratory experience to complete assignments. It was estimated that laboratory work accounts for 50 percent of scheduled time.

Undergraduate Space Requirements

Classrooms: Some members of the discussion group forecast a need for classrooms with interactive computers at each student station, linked to that of the professor. It was estimated that such an arrangement would increase station sizes in large lecture halls by about one-third. A need for television monitors and facilities for other media in the classroom was also noted.

Teaching Labs: The equipment "explosion" has affected space needs in the teaching lab. New equipment does not simply replace the old but instead it increases the opportunities for experimentation. With an increase in equipment, storage needs also have increased. Some programs have additional storage needs for teaching collection, such as geology sample collections.

The increased specialization in the sciences has resulted in a need for more dedicated labs, primarily at the upper division. Increased sophistication of experimentation has also increased preparation and disassembly times.

Graduate Instruction

Graduate 1 and Graduate 2 distinction suggested: Several programs in the physical sciences require scheduled laboratories on the graduate level, along with classroom-based courses. The distribution is approximately 50-50. At more advanced levels, however, graduate students spend nearly all their time doing laboratory research. A "Graduate 1/Graduate 2" distinction was suggested to better describe the space needs of graduate students in these disciplines.

Graduate lab/office needs: It was suggested that the graduate student office allowance be increased from 15 ASF to 50 or 60 ASF and that office space for graduate students should be designed as part of research laboratories.

Support Space

Increased need for support space: The combination of additional equipment and more extensive field work has contributed to an increased need for support space. Space is needed for special equipment, maps, generators and a range of field supplies and equipment. Shop space needs have increased with space needed for technicians to repair and calibrate sensitive equipment. The 10 percent allowance was felt to be inadequate.

Research Programs

The growing role of the postdoctoral fellow: One of the significant changes in the physical sciences has been the growth in the number of postdoctoral fellows. These externally funded positions are now fundamental participants in the research team. The existing standards provide no space allowance for these positions since they are not funded from State funds.

The research team: A team approach to research is used in most areas of the physical sciences and engineering. Teams include faculty, postdoctorals, graduate and undergraduate students and are assisted by staff which includes technicians, secretaries, draftsmen, photographers, computer programmers, etc. Team size varies widely, often depending on the subject of the research.

Impact of specialization: With the growth in sophistication of equipment and the scientific advances made in recent years, research has become more specialized and involves elaborate equipment including lasers, computers, reactors, wind tunnels etc. Increased specialization makes it more difficult to interchange space among research projects.

Academic Offices

Factors affecting the space standards: Several factors were cited which suggest a need for a larger office allowance. It was estimated that 20 square feet is needed for computer work. In addition, the need to store (and have access to) a growing amount of "grey" literature not formally published was cited as a high priority.

Increase in emeriti and visiting faculty: The number of emeritus faculty and visitors has increased and, in the case of emeriti, is estimated to grow rapidly in the future. It was recommended that some allowance be made for these individuals who make a contribution to the university.

Summary

- The computer, both main frame and micro, has had a significant effect on the physical sciences and engineering, making new procedures possible but also increasing space needs. The development of laser and remote imagery technology also has changed space needs.
- The potential for computer use in the classroom could require a larger student station allowance.
- Scheduled lab instruction is now common for first stage graduate students.
- Increased equipment has impacted space requirements in laboratories and in storage and support facilities.
- Postdoctoral fellows now play an expanding role in research. However, their space needs are not recognized by current standards.
- The common use of the computer in the office

suggests a need for some increase in the office space allowance.

PSYCHOLOGY AND BEHAVIORAL SCIENCES

The category includes the various fields within psychology and cognitive science. Existing facility planning standards for psychology were based on ½ social science and ½ biological science standards and are as follows:

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	12.8	(61%)	15
	Class Lab	8.1	(39%)	43
	Total	20.9	(100%)	
Upper Division:	Classroom	13.1	(67%)	15
	Class Lab	6.5	(33%)	45
	Total	19.6	(100%)	
Graduate:	Classroom	8.2	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			125/FTE
	Graduate student			15/headcount
	Administrative allowance			40/academic FTE
Research Space:	Academic FTE			300/FTE
	Graduate student			80/headcount
Support Space:	Allowance of 7.5% of total of above categories			

Factors Affecting Undergraduate Instruction

Diversity in the field: Within the field of psychology, there is a substantial diversity among the various specialties. Some areas of specialization include: developmental psychology, educational psychology, psycholinguistics, clinical psychology, survey/social research, psychobiology, and, as a separate area, cognitive sciences. The diversity of specialties has a direct bearing on space needs due to different emphases in the curricula, different types of laboratory facilities, and differing research emphases.

Growth in size of lecture classes: Due to a combination of increased demand and the need for more intensive lab work at the upper divisions, the size of introductory lecture sections has continued to grow, complemented by a reduction in the size of discussion sections. In addition, there is a trend toward a larger class size in upper-division lectures. This suggests a need for both large and small general purpose classrooms.

The impact of the computer: The computer has had a major impact on psychology and cognitive science. Experiments in memory and in sensory threshold are now done on computers. In the past, behavioral psychology used one-way mirrors for observation; now video tapes and computers are used. There is also extensive use of self-paced computer labs with increased expectations for independent work by students.

Shift of laboratory emphasis to upper division: At most campuses, there has been a significant reduction in laboratory experience in lower-division courses. At the same time, laboratory courses and experimental emphasis at the upper-division level have increased. In courses involving human subjects, lab hours are twice that of lecture with an equal amount of unscheduled lab experience. In courses involving animal subjects, the ratio is four lab to three lecture hours, while in other areas the range is from one-third to one-half laboratory hours. The number of lab hours per week estimated by the discussion group for lower-division students was for less than the existing formula assumptions while upper-division lab hours were estimated to exceed the formula.

Undergraduate Instruction Space Requirements

Classrooms: Overall, the discussion group felt the only major change in classrooms would be an increased use of media. They urged that cabling and media capability be available in classrooms along with darkening capabilities. Some of the discussion group members saw a role for computers in the classroom in the near future. In response to the trend toward larger lectures and more discussion groups, the group felt there was a need for more large classrooms and small seminar rooms.

Laboratory categories are needed to reflect space requirements: In discussing teaching laboratories, the group felt that the subject area nomenclature did not sufficiently describe laboratory needs. They felt that lab standards for these fields could be better developed within the following framework:

- human experimental labs,
- human observation labs,
- animal experimental labs,
- survey research/statistics labs, and
- theory and modeling labs.

The experimental labs have task-oriented rather than people-oriented work stations, with extensive equipment and wet-lab set-up.

In the experimental and observation labs, high quality controls over lighting and sound levels were felt essential for the validity of the experiment and observation.

New animal care regulations have increased laboratory space needs.

Observation labs require a central equipment room, separate work areas, video editing and television facilities, and separate observation areas.

Less space is needed in the survey and modeling labs which are more oriented toward statistics and the use of computers. Space is required for data coding and processing, as well as project meeting space.

In many cases, the specialized nature of the laboratory requires its dedication to a single course at a time.

Graduate Instruction

Orientation to the Ph.D.: The programs in psychology reflect a direct orientation to the doctorate. Specialized upper-division work has become more individualized. However, in the first year of graduate study there are scheduled lab courses in several specialties, such as physiology, visual instrumentation, statistics, or clinical practice. In the following years, the orientation is to individualized research, often as a part of a research team.

Need for seminar space: A significant concern of the discussion group was the need for seminar rooms to be used on an "unscheduled" basis to provide space for meetings between faculty advisors and graduate students.

Support Space

In the experimental labs, which require special equipment and extensive utilities, the 7.5 percent support allowance was felt to be most inadequate. In other areas, the major need expressed was for computer support and for repair facilities for complex instrumentation along with darkrooms, photo labs, media rooms, and space for field work coordination.

Research Programs

Growing role of postdoctoral fellows: In the areas of psychology most closely related to the biological sciences, there is a large component of postdoctoral fellows. Their number is growing in the other areas, but is dependent on external funding. Most new faculty have postdoctoral experience and research programs are increasingly oriented to the inclusion of postdoctorals.

The use of research teams:

- In human experimental labs, teams include one faculty member, graduate and undergraduate students, postdoctorals where available, and support staff. Multi-faculty teams, with larger numbers of students, are also common. In this field, reception and waiting room space is a necessity.
- In human observation labs, team size is similar and observational capability is needed, as is extensive computer and film editing space.
- In animal experimental labs, the teams are similar to those in the biological sciences.
- In the survey area, team size varies substantially. Computers play a large role as they do in research in the cognitive sciences. Space for field work coordination is important but is often overlooked.

Academic Offices

Effect of the computer: Discussion-group members felt that the existing allowances did not provide the space needed to use current technology and lack of space encourages faculty to work elsewhere.

Emeriti and visitors: A common problem expressed was to house an expanding number of emeritus faculty and visitors who provide services to the university.

Summary

- Psychology has a variety of specialized areas within the discipline and therefore has different laboratory facilities needs depending on the subject area.
- The size of introductory classes has grown, while discussion sections have decreased in size.

- Computers have made a definite impact on programs in psychology and cognitive science and are used extensively in these areas.
- The laboratory emphasis has shifted from lower-division courses to upper-division courses.
- Laboratory needs can best be described by grouping the psychology labs into five main lab categories. The needs vary depending on the type of lab.
- Course work and research become more individualized and more specialized at the graduate level. Seminar rooms are needed for meetings with faculty and graduate students.
- The support space allowance is inadequate for experimental and wet laboratories.
- Research programs in psychology and cognitive science frequently include postdoctorals.
- Research is primarily conducted on a team basis. Team sizes vary by subject area.
- The office space allowance was felt to be inadequate to accommodate computer equipment and to house visiting faculty.

SOCIAL SCIENCE AND HUMANITIES (OFFICE-BASED)

These two categories encompass a broad range of programs including history, political science, economics, urban studies, sociology, English, literature, philosophy, rhetoric, etc. They do not include laboratory-based disciplines. Existing facilities planning standards for the two categories are similar and are displayed below:

SOCIAL SCIENCES

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	15.0	(88%)	15
	Class Lab	2.1	(12%)	30
	Total	17.1	(100%)	
Upper Division:	Classroom	14.6	(95%)	15
	Class Lab	0.8	(5%)	30
	Total	15.4	(100%)	
Graduate:	Classroom	13.5	(100%)	15
	No scheduled class lab standard			

HUMANITIES

		WSCH per FTE Student (15 Credit Hours)	ASF/ Station
Lower Division:	Classroom	18.9	15
	Class Lab	0	
	Total	18.9	
Upper Division:	Classroom	15.0	15
	Class Lab	0	
	Total	15.0	
Graduate:	Classroom	15.0	15
	No scheduled class lab standard		

SOCIAL SCIENCES AND HUMANITIES

Office Space:	Academic FTE (Faculty + TAs)	130/FTE
	Graduate student	30/headcount
	Administrative allowance	30/academic FTE
Research Space:	Academic FTE	40/FTE
	Graduate student	0/headcount
Support Space:	Allowance of 5% of total of above categories	

Factors Affecting Undergraduate Instruction

Increased use of the computer: The most significant factor noted was the computer and its use in undergraduate instruction. Mathematically-oriented disciplines such as economics and those emphasizing quantitative methods offer scheduled computer laboratory courses. Other examples of computer-based instruction include courses in logic, composition, and literary analysis. All of the disciplines rely on the computer for augmentation through assigned independent study. There is a greater reliance on independent study and a need for more scheduled and open access computer labs was indicated.

Other Factors

- There has been an increase in the use of media in the disciplines in this area. For example, rhetoric classes focusing on oral argument techniques require a video lab.
- The use of teaching assistants has increased in support of more discussion or lab sections.
- In non-laboratory courses, a typical pattern is four hours of lecture and a one-hour discussion section, while in economics and quantitative methods, the pattern was typically three hours of lecture and one to two hours of lab.

Undergraduate Space Requirements

Classrooms: Seminar space is at a premium and a need for both larger and smaller classrooms was reported. No concerns were expressed over station size.

Teaching Labs: The development and increased availability of specialized software has generated a need for dedicated computer labs in several disciplines. Open labs available on a campus-wide basis are satisfactory for word processing and general statistical applications. Work space is needed for teaching lab support personnel.

Graduate Instruction

Seminar space: The most pressing concern indicated was a need for seminar space for both formal and unscheduled instruction. One seminar room per 20 faculty was suggested. Overall, the current instruction pattern is quite similar to that outlined in the standards.

Support Space

Departmental collections: The need for space to house the growing number of non-circulating journals, case studies, reprints, and "gray" materials not normally included in central library collections was expressed. Such departmental reference libraries are often used as study areas for graduate students and informal commons spaces for faculty and students.

Coordination of field studies: Undergraduate programs with field studies require space for staff who coordinate these programs, which may be offered in community studies, environmental studies, economics, education, or psychology.

Research Programs

Use of offices: In these disciplines, research is primarily conducted in offices and an insufficiently-sized office was noted as a problem. However, the combination of research and office space allowances in the existing standards appear to be adequate.

Team approach: There has been an increase in the development of research teams organized around focused topics in most of these disciplines. The teams are increasingly interdisciplinary, faculty may have a joint appointment in two departments, and the size varies with the scope of the project. Teams will include a principal investigator, two or more other faculty, two or more graduate students, and often several undergraduates. While not as common as in the natural sciences and engineering, there has been available funding for postdoctoral fellows in recent years, with one to two postdoctoral fellows estimated per social science department. Space needs attributed to the interdisciplinary teams are conference room space for meetings of the research team, computer labs for accessing large data bases, and project offices.

Academic Offices

Space needs for research and graduate instruction: In addition to the concerns noted above, it was pointed out that faculty offices often are used for graduate instruction.

Increase in emeriti and visiting faculty: The number of emeriti faculty contributing to the University has increased, as has the number of visiting professors. The need for an allowance to provide some space for these individuals was expressed.

Summary

- The growth in the use of the computer is probably the most significant single factor affecting these disciplines.
- There has been an increase in laboratory and discussion sections since the standards were developed.
- There has been a substantial growth in informal resource materials affecting the need for storage space.
- A need was expressed for seminar or conference rooms for graduate instruction and to support an increasing interdisciplinary planning approach to research.

VISUAL ARTS

The visual arts encompass programs in painting, sculpture, photography, ceramics and metal work, as well as art history and appreciation. Facility planning standards and assumptions are the same for all of the "arts" disciplines including both the visual and performing arts. Existing facility planning standards are:

		WSCH per FTE Student (15 Credit Hours)		ASF/ Station
Lower Division:	Classroom	10.3	(37%)	15
	Class Lab	17.3	(63%)	65
	Total	27.6	(100%)	
Upper Division:	Classroom	9.9	(37%)	15
	Class Lab	16.9	(63%)	65
	Total	26.7	(100%)	
Graduate:	Classroom	6.4	(100%)	15
	No scheduled class lab standard			
Office Space:	Academic FTE (Faculty + TAs)			140/FTE
	Graduate student			15/headcount
	Administrative allowance			50/academic FTE
Research Space:	Academic FTE			100/FTE
	Graduate student			125/headcount
Support Space:	Allowance of 10% of total of above categories			

Factors Affecting Undergraduate Instruction

Separation of art history/appreciation from art practice: There is a growing trend towards a practice orientation in visual arts programs. A clear distinction should be made between art history and art practice programs. Historically, art in higher education was studied from an observer's rather than a practitioner's standpoint. Separate practice departments began to be developed in the 1960s. Now, virtually all of the campuses have separate departments. The distinction between theory/history and practice is significant since the instructional mode in the former is primarily lecture/discussion while studio experience is emphasized in art practice. Existing space standards were developed at a time when there was greater emphasis on theory than practice and consequently the standards underestimate the need for studio space.

Increased use of visual aids/media support: In the case of art history, both students and faculty need to have ready access to visuals. In the past, this had been in the form of slide collections. There is now the ability to use compact disk technology in conjunction with computers to provide the necessary visual examples both in the classroom (through monitors) and in resource centers. Since the library is a primary resource center for art history, a question exists as to whether space for slide (or other media) collections maintained outside of the library should be considered as non-standard space.

Increased need for studio space: In the art practice areas, students primarily need studio space at both the lower and upper division. There is a strong emphasis on studio experience, with students spending approximately twice as much scheduled time in studio space (lab) as in lecture space. At some campuses, many lecture components are given in the studio. As it was expressed in the discussion group, the studio -- and related support space -- is the artists' library space. The basis of learning in art practice is primarily through experimentation.

Increased combination of lecture/discussion: The sense of curriculum distribution which emerged from the discussion group was a pattern in art history which is similar to the humanities and involves a combination of lecture and discussion. A three-unit course would involve four to five contact hours; three in lecture and one to two hours in the discussion section. Some independent work with visual collections is also expected.

Heavy "lab" emphasis in the practice disciplines: In the case of practice disciplines, the distribution between lecture and studio was approximately 1:2, with four units equaling six to eight contact hours. The most frequently cited ratio of scheduled contact hours to credit units was two to one, with an expectation of as much non-scheduled studio use as scheduled at the upper division.

Undergraduate Instruction Space Requirements

Increased need for "work-in-progress" space: A point frequently made was the particular problem of "work in progress" in the practice areas. Either studios should be dedicated (in the case of large works which cannot be moved), or sufficient storage space must be available. The problem most directly affects upper-division courses where non-traditional and innovative work is stressed. A desirable studio section size of not more than 20 students was cited, with approximately 1,300 ASF for the studio plus 650 ASF (50 percent) for storage for the 20 students. This would be close to 100 ASF per student as opposed to the current allowance of 65 ASF.

Additional factors affecting space requirements are new approaches to art such as performance art, and new media, such as computer-based art, which often require large spaces. Art can no longer be considered a "table-top" activity. Certain programs have requirements for extensive support space outside of the core studio, including sculpture, print-making, photography, and ceramics.

Classroom standard adequate for art history: In the area of art history, the predominant teaching space is the classroom. No concern was expressed about the existing standard of 15 ASF per station. The need for up-to-date media support to provide high quality multi-slide or similar presentations was noted along with the need for support space to edit and prepare presentations.

Graduate Instruction

Increase in seminars and reduction of lectures in art history: The trends affecting graduate instruction in the visual arts are essentially the same as those affecting undergraduates. The distinction between art history and the practice disciplines is sharply drawn, with the Ph.D. being the terminal degree in the former and the Master of Fine Arts (MFA) in the latter area. Curriculum in art history involves a limited amount of lecture (one to two hours per week) and from five to six hours of seminar plus research expectations requiring full-time commitment. Libraries, museums, and slide or other visual collections are the primary locus of research.

Increased use of scheduled labs common in art practice courses: In the art practice areas, the lecture/seminar commitment is less (approximately three hours per week) but the studio component is extensive. The discussion group noted the existence of scheduled graduate studio (lab) courses which are not envisioned by existing standards. This involves approximately three contact hours per week In addition, the graduate student is expected to spend "all waking hours" in the studio. This leads to extensive competition for on-campus space and sometimes the need for a graduate student to rent space off campus. In some cases, on-campus studio space is set aside and scheduled for graduate student use. A minimum size of 225 to 250 ASF per graduate student lab was cited, with a feeling by many that a desirable studio would be 500 to 600 ASF. Proper lighting and increased ceiling height were also indicated as priority needs.

Support Space

Increased need for support space: Many examples of the need for support space were identified. These included media production and editing rooms for preparation of visual aids, storage space for visual collections, centralized viewing rooms, darkrooms for both developing student work and media preparation, lockers for students and, as noted earlier, space to store work-in-progress. In addition, the need for wood and metal shops as well as storage space for other raw material used in the creation of art was also cited. Gallery space to exhibit the art was also indicated as an essential requirement. At least 1,200 ASF in gallery space was felt to be necessary.

Support positions requiring space include:

- shop manager,
- media repair technicians,
- film assistants,
- darkroom technicians,
- media center personnel,
- computer center technicians, and
- slide librarians.

Research Programs

Art practice research should be done on campus: Outside of art history, the research focus of faculty is in their creative activities. In the view of most discussion group members, this creative work should be done on campus in studio space dedicated to the faculty member. In the 1950s and 1960s, on-campus studio space generally was not available for faculty. The increased use of technology, the desire to have faculty available on campus, and the difficulty in renting suitable off-campus space has provided the impetus for developing on-campus studio space for faculty. The new visual arts facility now being planned at the San Diego campus includes faculty studios (which also include an office component) of 1,056 ASF. "Research" in this area is individual and no postdoctoral fellows are involved.

Academic Offices

Increased use of computers: The discussion group noted the increased use of the personal computer in most offices and the need for a light table in the art historian's office. It was felt that, as a rule, 135 to 150 ASF was an appropriate standard for faculty offices, the latter in the case of the historian

Increased part-time faculty: There is a significantly high proportion of part-time faculty in this field One-third of FTE positions may be filled by part-time faculty due, in large part, to the number of specialties in the arts, the need to provide instruction in a wide variety of techniques, and the desire to involve practicing artists.

Increased need for space for visiting faculty: Space for visiting faculty was felt to be a high priority need, although the group felt that studio rather than office space was needed.

Summary

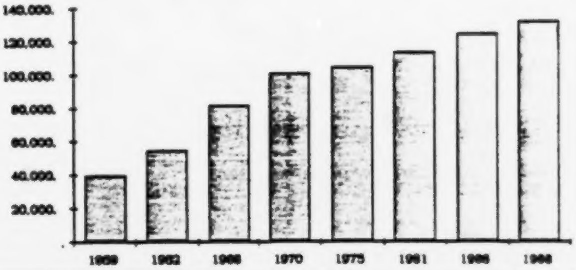
- Within visual arts programs, the distinction between theory and practice must be made with the former area operating in a manner similar to the humanities or social sciences. Existing space standards were developed at a time when there was greater emphasis on theory than practice.
- There is a growing trend for greater hands-on experience by students, which accentuates the need for studio (lab) space, both scheduled and unscheduled, which probably was not envisioned when the standards were developed.
- The proportional distribution between lecture and lab in existing standards was supported (with perhaps a slightly greater emphasis on lab) in the case of the practice disciplines. However, few, if any, labs are involved in art history courses.
- Teaching studio space allowances were a point of concern, with between 1,200 and 1,300 ASF cited as a desirable size for a 20 student section.
- Support space may be the most critical need in the practice area with significant requirements for shops and storage. In art history, the need is for media production and storage area.
- Studio space for creative activity for faculty and graduate students was felt to be a high priority.

3.4 Enrollment Changes Through the Years

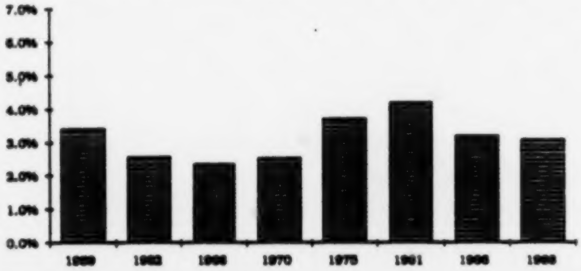
In addition to seeking opinions from knowledgeable individuals about changes occurring in specific disciplines, Phase III activities included evaluating enrollment changes since standards were established. The following charts, prepared from information provided by the University of California and the California State University, depict how the proportion of students in each discipline has changed at specified intervals since the late 1950s and early 1960s.

University of California

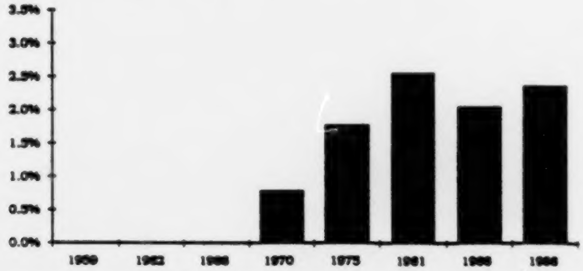
Total Number of Students Enrolled



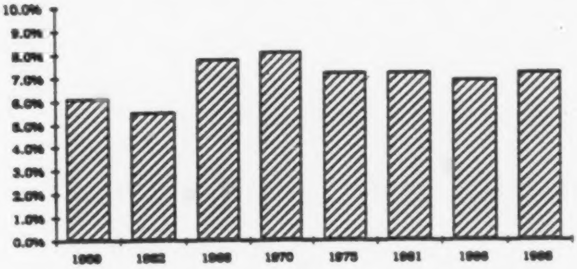
Proportion of Students Enrolled in Agriculture



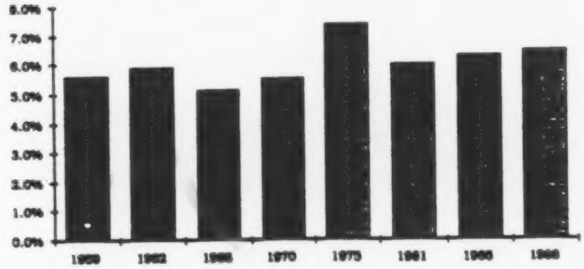
Proportion of Students Enrolled
in Area/Interdisciplinary Studies



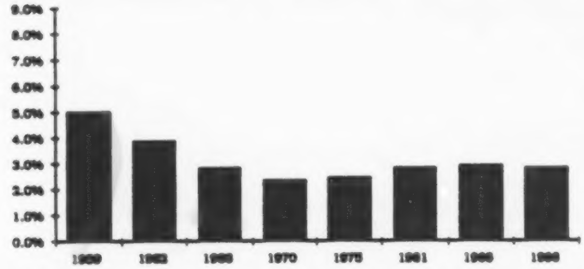
Proportion of Students Enrolled in Arts



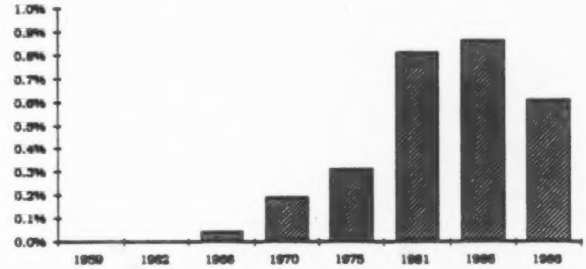
Proportion of Students Enrolled in Biological Sciences



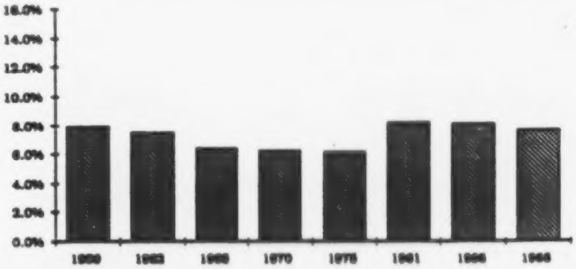
Proportion of Students Enrolled in Business



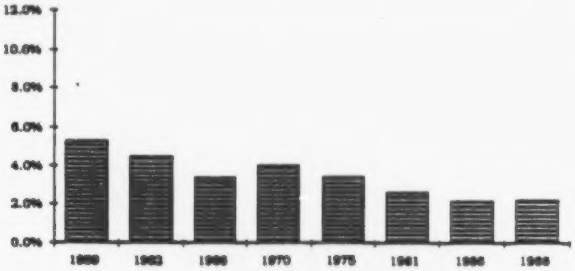
Proportion of Students Enrolled in Computer Science



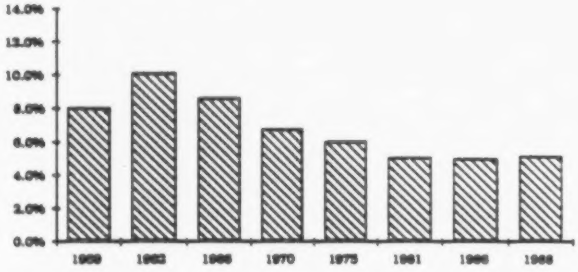
Proportion of Students Enrolled in Engineering



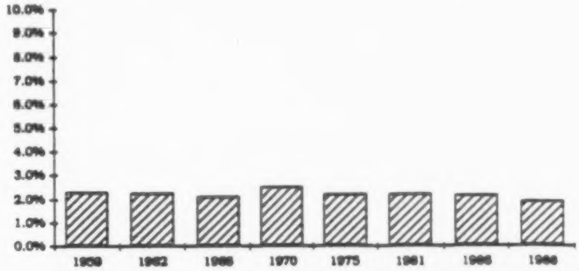
Proportion of Students Enrolled in Education



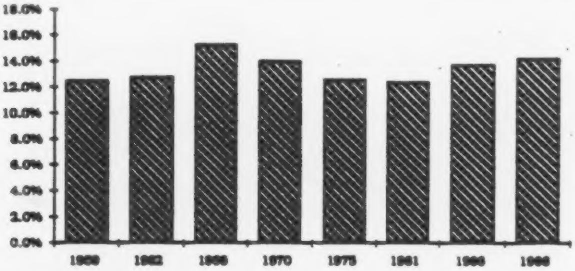
Proportion of Students Enrolled in Foreign Language



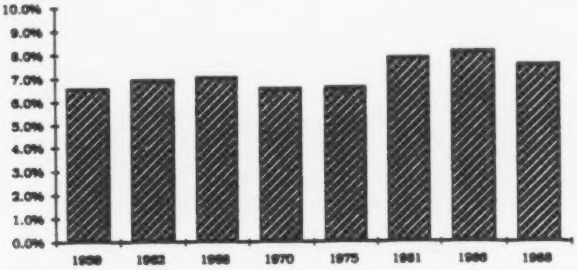
Proportion of Students Enrolled in Law



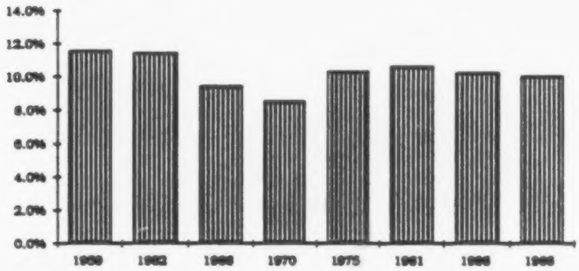
Proportion of Students Enrolled in Letters



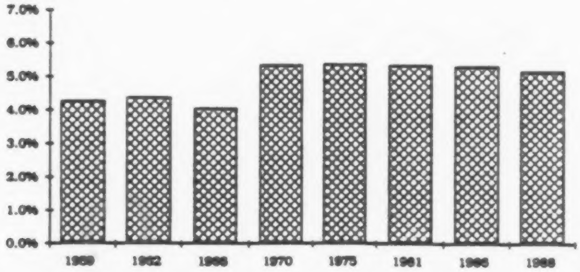
Proportion of Students Enrolled in Mathematics



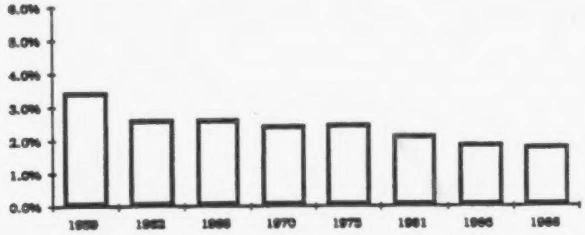
Proportion of Students Enrolled in Physical Sciences



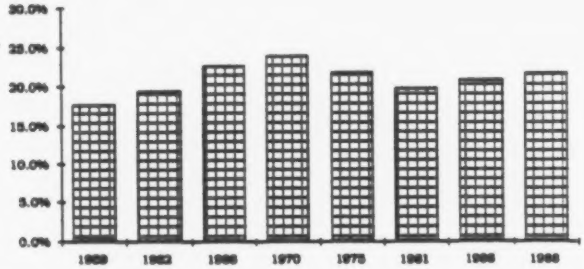
Proportion of Students Enrolled in Psychology



Proportion of Students Enrolled in Professional Programs

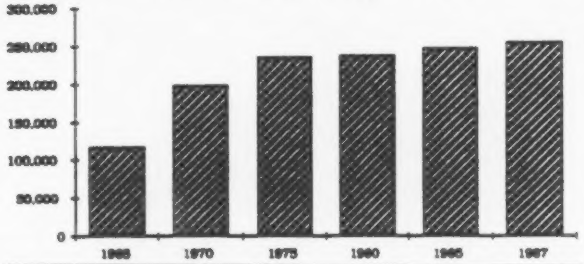


Proportion of Students Enrolled in Social Sciences

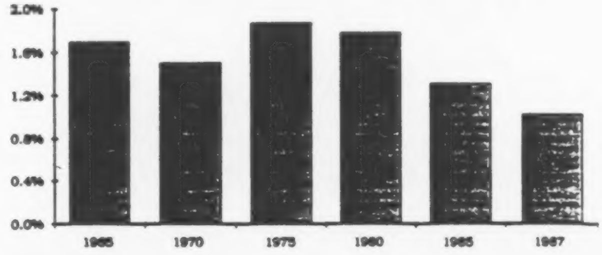


California State University

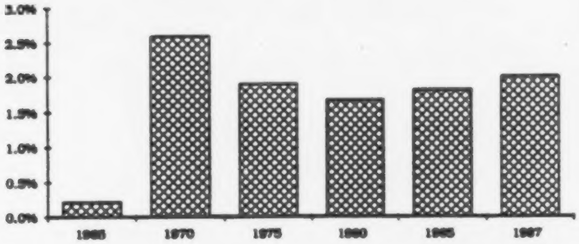
Total CSU Enrollment from 1965 to 1987



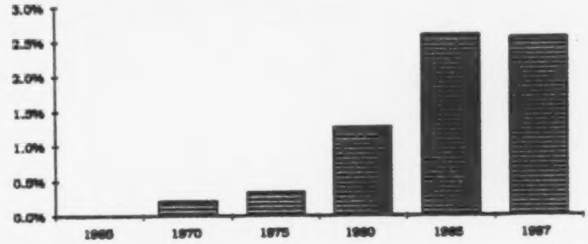
Proportion of CSU Enrollment from 1965 to 1987 in Agriculture and Natural Resources



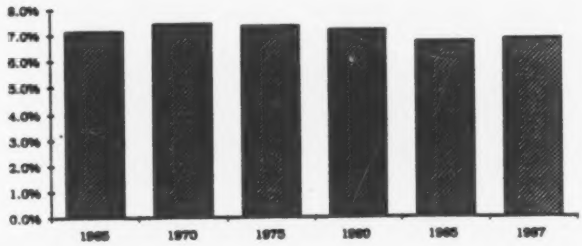
Proportion of CSU Enrollment from 1965 to 1987 in Area or Interdisciplinary Studies



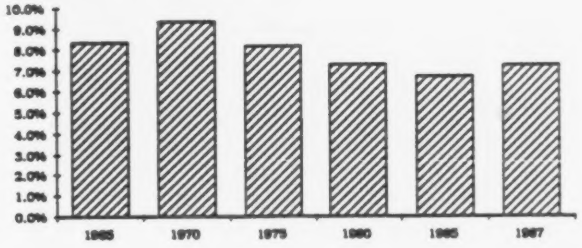
Proportion of CSU Enrollment from 1965 to 1987 in Computer Sciences



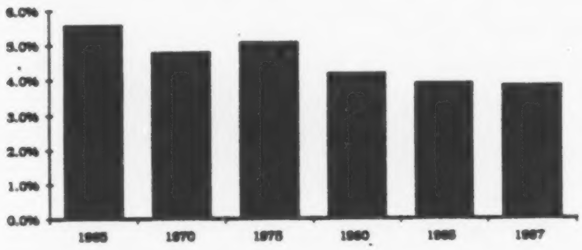
Proportion of CSU Enrollment from 1965 to 1987 in Arts



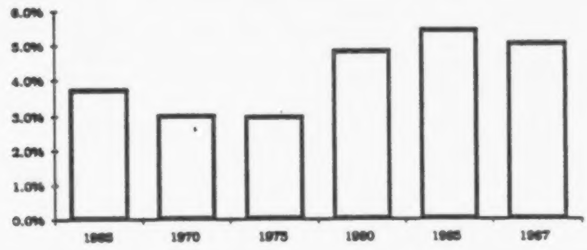
Proportion of CSU Enrollment from 1965 to 1987 in Education



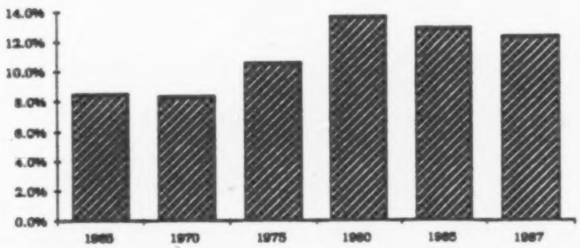
Proportion of CSU Enrollment from 1965 to 1987 in Biological Sciences



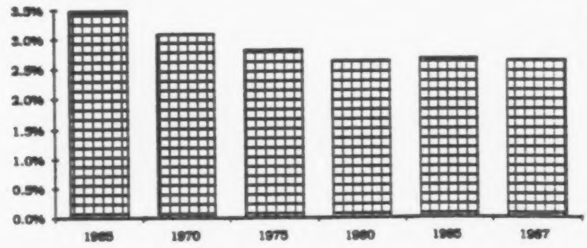
Proportion of CSU Enrollment from 1965 to 1987 in Engineering



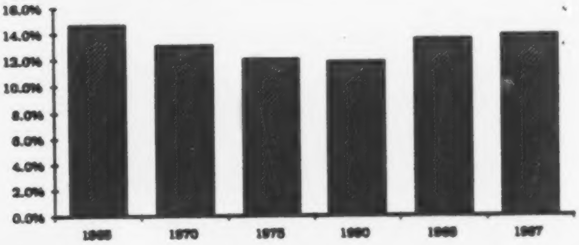
Proportion of CSU Enrollment from 1965 to 1987 in Business



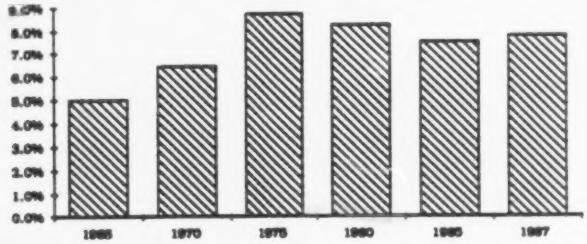
Proportion of CSU Enrollment from 1965 to 1987 in Foreign Language Studies



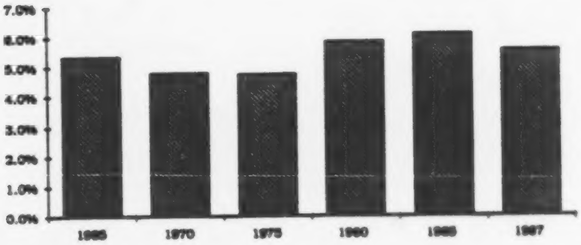
Proportion of CSU Enrollment from 1965 to 1987 in Letters



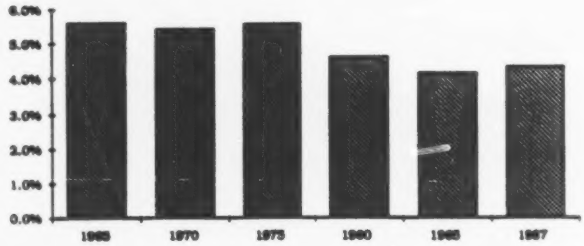
Proportion of CSU Enrollment from 1965 to 1987 in All Other Professional Programs



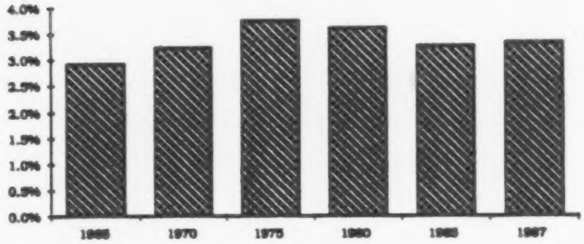
Proportion of CSU Enrollment from 1965 to 1987 in Mathematics



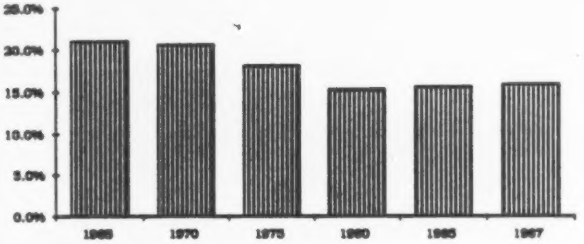
Proportion of CSU Enrollment from 1965 to 1987 in Psychology



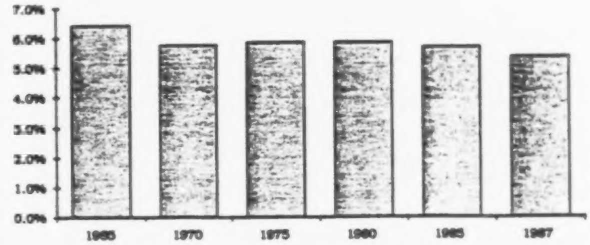
Proportion of CSU Enrollment from 1965 to 1987 in Physical Education



Proportion of CSU Enrollment from 1965 to 1987 in Social Sciences



Proportion of CSU Enrollment from 1965 to 1987 in Physical Sciences



4

A Guide to Evaluating California's Facilities Planning Standards/Guidelines

DURING our review of facilities planning standards/guidelines used in other states, the magnitude of effort required to complete a comprehensive review of California's standards became very clear. The work must go well beyond simply looking at what California and other states are doing and adopting the mean, median or something else that "looks reasonable." To a degree, such an approach would amount to circular logic in that many other states originally adopted California's standards. In addition, although many states have updated standards/guidelines periodically, most have not completed a comprehensive analysis to test the validity and reliability of their standards/guidelines.

As the Advisory Committee on Space and Utilization Standards/Guidelines shifts into the mode of a working committee, it should review, discuss, and test every value and assumption used in current standards for each category of space. We believe this is the appropriate way to complete the level of evaluation intended by the Legislature. This approach is also appropriate in light of the potential impact of this Committee's deliberations on higher education in California.

To help guide the Committee in its work, on the following pages we present an outline of issues and questions to be answered in assessing the need for new or revised standards/guidelines. Similar to a decision tree, the issues listed move from strategic to operational levels so that the Committee can work logically and efficiently through the process.

Outline to Evaluate California's Space and Utilization Standards/Guidelines

I. *Basic Issues*

A. Should California have facilities planning and budgeting standards/guidelines? Reasons include:

- A tool for evaluation of relative need for space within limited resources;
- Need for criteria to plan new campuses;
- Legislative and control agency environment requiring project level justification; and
- A need to promote cost-effective capital development.

If standards/guidelines continue to be used, the Committee must assure that any revised standards/guidelines:

- Are objective;
- Are valid (accepted as fairly representing need);
- Are supported by sound and accurate data systems; and
- Provide a sound basis for evaluating the need for space.

B. Should the standards/guidelines be considered as absolute directives, operating as design criteria, or considered to be budgetary guidelines with flexibility afforded to the segments, districts and campuses to reflect local differences?

C. At what level and how should standards/guidelines be applied?

1. At the State level to evaluate relative priorities?
2. At the State level to evaluate space needs at the:
    (a) campus level,
    (b) discipline level,
    (c) project level, or
    (d) room level?
3. At the State level to monitor utilization performance?

4. At the segment level to evaluate relative priorities?
5. At the segment level to evaluate space needs at the:
    (a) campus level,
    (b) discipline level,
    (c) project level, or
    (d) room level?
6. At the segment level to monitor utilization performance?
7. At the district level to evaluate relative priorities?
8. At the district level to evaluate space needs at the:
    (a) campus level,
    (b) discipline level,
    (c) project level, or
    (d) room level?
9. At the district level to monitor utilization performance?
10. At the campus level to set project priorities?
11. At the campus level to evaluate space needs at the:
    (a) discipline level, or
    (b) room level?
12. At the campus level to design projects?
13. At the campus level to monitor utilization performance?
    (a) Do the standards/guidelines need to be the same for each segment in cases where functions are the same?
    (b) Within segments, should the standards/guidelines differentiate between campus based on factors such as size, location, etc?

D. Should the scope of this study continue to be limited to classrooms, teaching labs, research labs, academic and departmental offices and related support space?

II. *Teaching Space*

A. "Teaching space" includes classrooms, lecture and seminar rooms, instructional laboratories (including general and special laboratories) and directly related service and support space. It does not include departmental conference rooms, auditoriums, animal quarters, greenhouses, vivarias, research laboratories and certain unscheduled activity space.

Should each segment use a common definition of teaching space as it applies to calculating "capacity"? If not, should a common definition be used?

B. Scope of the standards/guidelines

1. Should classrooms, teaching laboratories, and related support space continue to be considered capacity space requiring standards/guidelines?
2. Should particular categories of space be included in or excluded from the standards/guidelines?
    (a) Should standards/guidelines be extended to space such as language labs, computer labs, and related support space, etc? How should the need for such space be calculated?
    (b) Should temporary space, e.g., trailers, be included in the inventory? If consideration is given to this situation, how should "temporary" be defined?
    (c) Should leased space (and associated contact hours) be included in the inventory and capacity count?

C. Should the basic structure of the existing formula approach to determining ASF for teaching space be continued?

D. Taxonomy Issues -- The educational environment

1. Should the standards/guidelines for teaching space use taxonomic subdivisions in calculating space needs.

2. Can the same basic taxonomy be used by each segment (with additions for specialized programs in a segment) or do role and mission differences suggest three separate taxonomies? If there are different taxonomies, is there a way to assure comparability in evaluating segment needs?

3. What should be the level(s) of detail of the taxonomies?

4. Does the taxonomy for space standards need to be based on disciplines? Can concepts such as "heavy/light" or "wet/dry" labs be used?

E. Counting system issues -- demand units

1. *What* should be counted and *how* should it be counted?

   (a) Each segment now uses a different counting system to calculate demand units to apply to the standards/guidelines.

   The University of California calculates Weekly Student Contact Hours (WSCH) with discipline specific formulas developed in the 1950s. The formulas state the number of lecture and lab WSCH per FTE students at the lower-division, upper-division, and graduate levels. The classroom and lab space allowances/per FTE student are then calculated and applied to future projections.

   To project capacity, the California State University uses the inventoried number of lecture stations times 2.33 to calculate lecture FTE. Inventoried lab stations are distributed between lower and upper division (including graduate). Lower-division stations are multiplied by .52 and upper division by .39 to equal FTE. The amounts are totaled to equal "capacity" and then compared to actual FTE enrollment.

   For projecting the need for a building, CSU uses a pre-assigned contact hour value for each course multiplied by student enrollment in the course to calculate WSCH. The contact hours are based on one hour for each unit of credit in lecture work, two hours per unit of credit in activity type instruction (e.g., workshops, physical activity) and three hours per unit of credit in laboratory work. Where courses are multi-modal (involving more then one type of instruction) the different types of instruction are determined in advance and scheduled hours fixed accordingly. The data are contained in the Course Section Report and linked to faculty workload calculations.

   The community colleges use actual counts of WSCH which are related to fall enrollment data maintained by the Department of Finance. The Department of Finance projections are used and either the actual ratio of WSCH/ENR is used or changes in the ratio are projected by the Chancellor Office. The amounts are applied to ASF/WSCH standards to calculate space needs.

   (b) Are the three approaches sufficiently compatible or should a single approach be used? Does the CSU system reflect actual practice? Should the UC and CSU convert to an actual WSCH count basis? Should the CSU and CCs convert to a discipline-based formula approach? If the UC approach is used and possibly extended to CSU and CCs, how should the appropriate formula relationships of WSCH to FTE by discipline be determined? How often should those relationships be reviewed? If a single approach is not feasible, how can compatibility be improved?

   (c) Are all appropriate credit or contact hours now being counted?

   (d) Should specific allowances be made for "expected" but non-scheduled use of capacity space? If so, how should such use be counted or estimated?

2. *Who* should be counted? (See Exhibit 3.3 in the Phase I report.)

   (a) Should only "State funded" enrollment and WSCH be counted as is now the case? Should enrollment in other credit-bearing classes be included? Should contract offerings in the community colleges be included if they serve a valid public purpose?

(b) Should the scheduled use of teaching labs by UC graduate students be acknowledged in the standards?

3. *When* should the counts be made?

(a) Do the current cut-off points capture the accurate level of demand? Should the timing vary among institutions to reflect unique factors?

F. Standards Issues

1. Classrooms

(a) What processes should be employed to determine/verify the appropriate station size and support space allowances for classrooms?

(b) Is the same average station size for classrooms appropriate for use in all institutions in a segment? Should the size vary by segment?

(c) Should there be multiple classroom station size factors based on room size categories? What are the implications of such a change?

(d) How many hours per week should classrooms be assumed to be available? Should adjustments be made to reflect the individual characteristics of institutions such as the nature of their student bodies, urban/rural locations, etc?

(e) Should utilization assumptions be similar regardless of time of day or day of the week?

(f) What station occupancy rate(s) should be assumed?

(g) How can non-scheduled (but expected) classroom utilization of capacity space be recognized?

2. Teaching Laboratories

(a) What processes should be employed to determine/verify the appropriate station size and support space allowances for teaching labs?

(b) Should discipline-based taxonomy categories continue to be used to identify different teaching lab station size needs? Would an aggregate allowance be sufficient or possibly an approach which used fewer categories?

(c) Should there be different teaching lab space allowances for lower and upper division WSCH?

(d) How many hours per week should teaching labs be assumed to be available? Should adjustments be made to fit the individual characteristics of institutions such as the nature of the student bodies, location, etc.?

(e) Is it appropriate to expect the same level of teaching lab use over the hours available for scheduling? Should varying utilization assumptions be made by time of day?

(f) What teaching lab station occupancy rate(s) should be assumed?

(g) Should occupancy rate distinctions continue to be made between lower- and upper-division lab courses?

(h) Are there disciplines where dedicated teaching laboratories are required? Should room use assumptions differ by discipline?

(i) How can non-scheduled (but expected) teaching lab utilization of capacity space be recognized?

III. *Office Space -- Academic and Departmental Administration*

A. This category includes all office/study rooms of faculty members, teaching assistants, postdoctorals, non-faculty academic research staff of all instructional departments including chairpersons' offices, and space for support personnel and service space and departmental conference rooms. Excluded are administrative offices including offices of deans and other senior academic administrators. Seminar rooms are also excluded if used for scheduled instruction.

1. Is the definition of office space consistent among the segments? If not, should a common definition be used?
2. Is the scope of the definition accurate and/or can it be improved?

B. Should space standards/guidelines apply to academic office space?

C. What should the methodology or formula for academic office space be based on?

D. Should office space allowances vary by discipline category (as in UC) or reflect an overall average?

E. Does differentiation of function (mission) among the segments affect their need for academic office space?

F. Should allowances be different, based on the proportion of part-time faculty?

G. Should an allowance be included for non-State funded personnel, e.g., emeriti, visiting faculty, etc? If so, to what extent?

IV. *Research Space*

A. "Research space" includes scientific laboratory areas generally characterized by the presence of laboratory equipment for staff and/or student experimentation or observation and directly related service and support space. It does not include vivaria and green house facilities or teaching laboratory space.

1. Is this definition of research space sufficiently inclusive to encompass the full range of research space?
2. Does the UC and CSU use a common definition of research space as it applies to calculating "capacity"? If not, should a common definition be used?
3. How should the "research/creative" space needs of arts/design/architecture, etc. faculty and students be recognized?

B. Can satisfactory standards be developed or adapted or should research space needs be considered on a case-by-case basis?

C. Is the current taxonomy appropriate to reflect differences in research space needs? Should a new categorization approach, discipline-based or other, unique to research space needs, be developed?

D. What should be the base formula for calculating research space needs? Personnel? The "research team"? Graduate enrollment? Dollars?

E. If a student/personnel based formula is continued, what categories of space should be included? Should non-State funded research personnel be recognized as a factor in determining research space needs? Should undergraduate research activity be recognized?

F. In what way should research space standards apply to the California State University?

CALIFORNIA POSTSECONDARY EDUCATION COMMISSION

THE California Postsecondary Education Commission is a citizen board established in 1974 by the Legislature and Governor to coordinate the efforts of California's colleges and universities and to provide independent, non-partisan policy analysis and recommendations to the Governor and Legislature.

Members of the Commission

The Commission consists of 15 members. Nine represent the general public, with three each appointed for six-year terms by the Governor, the Senate Rules Committee, and the Speaker of the Assembly. The other six represent the major segments of postsecondary education in California.

As of February 1990, the Commissioners representing the general public are:

Mim Andelson, Los Angeles;
C. Thomas Dean, Long Beach;
Henry Der, San Francisco;
Seymour M. Farber, M.D., San Francisco;
Rosalind K. Goddard, Los Angeles;
Helen Z. Hansen, Long Beach;
Lowell J. Paige, El Macero; *Vice Chair;*
Cruz Reynoso, Los Angeles; *Chair;* and
Stephen P. Teale, M.D., Modesto.

Representatives of the segments are:

Meredith J. Khachigian, San Clemente; appointed by the Regents of the University of California;

Theodore J. Saenger, San Francisco; appointed by the Trustees of the California State University;

John F. Parkhurst, Folsom; appointed by the Board of Governors of the California Community Colleges;

Harry Wugalter, Thousand Oaks; appointed by the Council for Private Postsecondary Educational Institutions;

Joseph D. Carrabino, Orange; appointed by the California State Board of Education; and

James B. Jamieson, San Luis Obispo; appointed by the Governor from nominees proposed by California's independent colleges and universities.

Functions of the Commission

The Commission is charged by the Legislature and Governor to "assure the effective utilization of public postsecondary education resources, thereby eliminating waste and unnecessary duplication, and to promote diversity, innovation, and responsiveness to student and societal needs."

To this end, the Commission conducts independent reviews of matters affecting the 2,600 institutions of postsecondary education in California, including community colleges, four-year colleges, universities, and professional and occupational schools.

As an advisory planning and coordinating body, the Commission does not administer or govern any institutions, nor does it approve, authorize, or accredit any of them. Instead, it cooperates with other State agencies and non-governmental groups that perform these functions, while operating as an independent board with its own staff and its own specific duties of evaluation, coordination, and planning,

Operation of the Commission

The Commission holds regular meetings throughout the year at which it debates and takes action on staff studies and takes positions on proposed legislation affecting education beyond the high school in California. By law, its meetings are open to the public. Requests to speak at a meeting may be made by writing the Commission in advance or by submitting a request before the start of the meeting.

The Commission's day-to-day work is carried out by its staff in Sacramento, under the guidance of its executive director, Kenneth B. O'Brien, who is appointed by the Commission.

The Commission publishes and distributes without charge some 30 to 40 reports each year on major issues confronting California postsecondary education. Recent reports are listed on the back cover.

Further information about the Commission, its meetings, its staff, and its publications may be obtained from the Commission offices at 1020 Twelfth Street, Third Floor, Sacramento, CA 98514-3985; telephone (916) 445-7933.

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FINAL REPORT, STUDY OF HIGHER EDUCATION SPACE AND UTILIZATION STANDARDS/GUIDELINES IN CALIFORNIA

California Postsecondary Education Commission Report 90-6

ONE of a series of reports published by the Commission as part of its planning and coordinating responsibilities. Additional copies may be obtained without charge from the Publications Office, California Postsecondary Education Commission, Third Floor, 1020 Twelfth Street, Sacramento, California 95814-3985.

Recent reports of the Commission include:

89-21 State Oversight of Postsecondary Education: Three Reports on California's Licensure of Private Institutions and Reliance on Non-Governmental Accreditation [A reprint of Reports 89-13, 89-17, and 89-18] (June 1989)

89-22 Revisions to the Commission's Faculty Salary Methodology for the California State University (June 1989)

89-23 Update of Community College Transfer Student Statistics, 1988-89: The University of California, The California State University, and California's Independent Colleges and Universities (August 1989)

89-24 California College-Going Rates, Fall 1988 Update: The Twelfth in a Series of Reports on New Freshman Enrollments at California's Colleges and Universities by Recent Graduates of California High Schools (September 1989)

89-25 Overseeing the Heart of the Enterprise: The Commission's Thirteenth Annual Report on Program Projection, Approval, and Review Activities, 1987-88 (September 1989)

89-26 Supplemental Report on Academic Salaries, 1988-89: A Report to the Governor and Legislature in Response to Senate Concurrent Resolution No. 51 (1965) and Subsequent Postsecondary Salary Legislation (September 1989)

89-27 Technology and the Future of Education: Directions for Progress. A Report of the California Postsecondary Education Commission's Policy Task Force on Educational Technology (September 1989)

89-28 Funding for the California State University's Statewide Nursing Program: A Report to the Legislature in Response to Supplemental Language to the 1988-89 Budget Act (October 1989)

89-29 First Progress Report on the Effectiveness of Intersegmental Student Preparation Programs: One of Three Reports to the Legislature in Response to Item 6420-0011-001 of the 1988-89 Budget Act (October 1989)

89-30 Evaluation of the Junior MESA Program: A Report to the Legislature in Response to Assembly Bill 610 (Hughes) of 1985 (October 1989)

89-31 Legislation Affecting Higher Education During the First Year of the 1989-90 Session: A Staff Report of the California Postsecondary Education Commission (October 1989)

89-32 California Colleges and Universities, 1990: A Guide to Degree-Granting Institutions and to Their Degree and Certificate Programs (December 1989)

90-1 Higher Education at the Crossroads: Planning for the Twenty-First Century (January 1990)

90-2 Technical Background Papers to *Higher Education at the Crossroads: Planning for the Twenty-First Century* (January 1990)

90-3 A Capacity for Learning: Revising Space and Utilization Standards for California Public Higher Education (January 1990)

90-4 Survey of Space and Utilization Standards and Guidelines in the Fifty States: A Report of MGT Consultants, Inc., Prepared for and Published by the California Postsecondary Education Commission (January 1990)

90-5 Calculation of Base Factors for Comparison Institutions and Study Survey Instruments: Technical Appendix to *Survey of Space and Utilization Standards and Guidelines in the Fifty States*. A Second Report of MGT Consultants, Inc., Prepared for and Published by the California Postsecondary Education Commission (January 1990)

90-6 Final Report, Study of Higher Education Space and Utilization Standards/Guidelines in California: A Third Report of MGT Consultants, Inc., Prepared for and Published by the California Postsecondary Education Commission (January 1990)

90-7 Legislative Priorities of the Commission, 1990: A Report of the California Postsecondary Education Commission (January 1990)

90-8 State Budget Priorities of the Commission, 1990: A Report of the California Postsecondary Education Commission (January 1990)

90-9 Guidelines for Review of Proposed Campuses and Off-Campus Centers: A Revision of the Commissions 1982 *Guidelines and Procedures for Review of New Campuses and Off-Campus Centers* (January 1990)